AMATEUR WORK

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SENSITIVE "WIRELESS" RECEIVER.

ARTHUR H. BELL.

In wireless telegraphy one of the chief difficulties which operators have had to contend with is the securing of a sensitive and reliable receiver of the wave impulses from the transmitting station. This is especially true where the distances between stations have been at all great, the energy from large coils not being adequate to operate the coherer, which has been the form of wave detector usually adopted by amateurs.

The detector here described is of quite a different character; the principles involved in its operation will not here be considered. It is not difficult to construct if care be used in the handling of the delicate wire which forms the contact with the electrolyte. The materials, with possibly the exception of this fine wire, known as Wollaston wire, are easily obtainable in any large town or city. Wollaston wire is made by silver plating fine platinum wire, then drawing down through dies, thus greatly reducing the diameter of the core of platinum wire. The silver plating is then taken off by suitable acids leaving the minute platinum core exposed. As it is a rather difficult matter to handle this wire, the amateur is advised to first use No. 40 gauged platinum wire until sufficient skill in its use has been attained to use the other to good advantage.

To make the detector, obtain a block of solid brass about 4 in. square and ½ or ¾ in. thick. This weight is needed to give solidity to the device and reduce vibration to a minimum. Also obtain a piece of brass rod 6 in. long, ⅜ in. thick and ½ in. wide. This is bent to the shape shown in the illustration by heating in a blast torch until ductile and easily bent. Holes are drilled and tapped in the feet for ¼ in. brass screws, the feet being filed off to a good contact with the base; or this frame may be brazed to the base.

In the center of the top, drill and tap a hole for a ¼ in. thumb screw with knurled head and fine pitch. Get as fine a thread as possible, as the adjustment is made with this screw, and a fine thread is desirable. In the lower end of this screw drill a hole for a No. 8 gauge brass wire, a short piece being fitted to this hole and the lower end slit by sawing with a fine fret saw. The burr made by slitting is removed with a fine file and one end of a short piece of the fine platinum wire is placed in this slit, which is then closed tight with nippers.

Obtain a piece of dynamo-brush about ⅓ in. square; round would be better but not so easily obtained. French arc-light carbon of a very fine grain will answer. Saw off a length of about ½ in. and coat the outside with several coats of shellac, using care not to get any on the top end. In the top drill a ⅛ in. hole about ⅜ in. deep. Mount this piece of carbon under the brass frame so that the platinum wire will be exactly in the center of the hole. This is done by coating the bottom of the cup with shellac, and before drying place it upon a piece of hard rubber which is attached to the brass block in the same way.

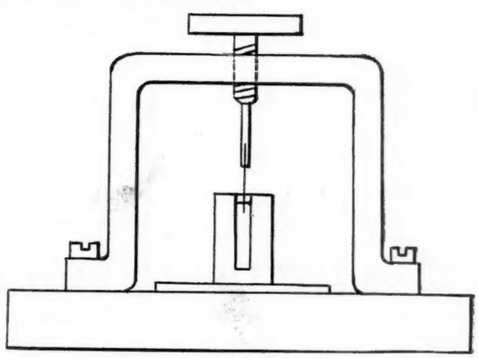


Fig. 1.

The leads are next attached, one to the carbon cup and one to the adjusting screw. Place a drop of soldering flux upon one edge of the top of the cup, also upon the end of a piece of double covered magnet wire, No. 18 gauge, then with a small soldering iron drop a bit of solder upon the wire which has been previously placed upon the cup. It is also advisable to make a

coil in this lead of about a dozen turns around a pencil, about 3 in. from the cup.

The other lead is soldered to the top of the adjusting screw and should have a similar coil of about a dozen

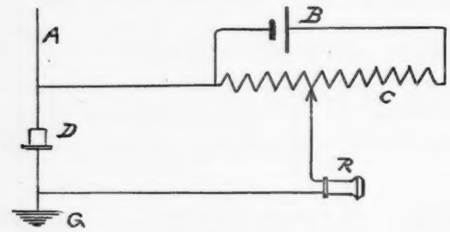


FIG. 2.

turns. These turns of wire are to ease any undue strain which might be brought upon the leads by the operator when handling.

The connections are shown in Fig. 2, in *D* which is the wave detector, *B* a local battery of one dry cell, *C* a variable resistance coil of about 50 ohms resistance, *R* a telephone receiver, *G* the ground and *A* the aerial. The construction of a resistance coil will be described in a subsequent article.

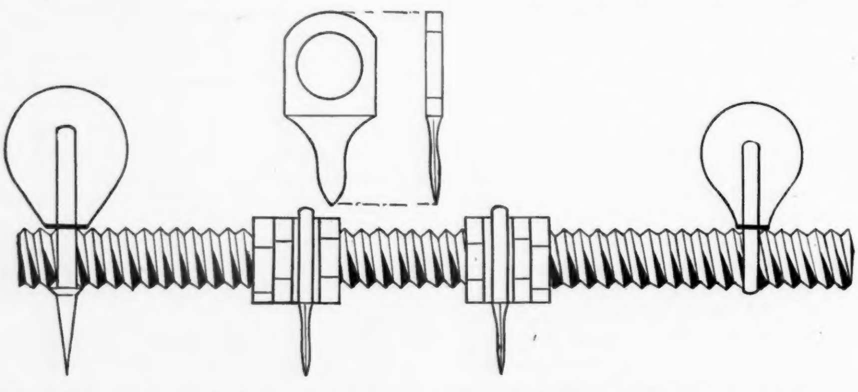
In making this detector, it will be advisable, to save breakage of the platinum wire, to put it in place after all the work is done and the detector in position for operating. A pair of long nose pliers of small size will be very servicable in handling the wire. When all adjustments are made the hole in the carbon cup is nearly filled with a solution of nitric acid and distilled or rain water; 1 part acid to 4 parts water. The platinum wire should enter the solution about ⅛ in.

A little experimenting will be necessary to determine the correct resistance of the coil *G*. Too much current will cause the platinum wire to be eaten away rapidly; too little will reduce the sensitiveness of the detector. The platinum wire should be removed from the electrolyte when through using.

WASHER CUTTER.

W. G. MILLER.

A tool to facilitate the cutting of discs and washers out of wood, fibre, rubber and soft, thin metal, is a necessity in most electrical and mechanical workshops. The writer recently, in a short space of time and at a very slight expense, constructed the tool here described, and found it a great labor-saver in shaping mica and fiber discs for insulating the sections of a high-frequency spark coil. The simplicity of construction and its adaptability to many purposes, commends it to all readers.



The rod is steel, 3 in. long; ⅜ or ¼ in. in diameter. One-half inch from each end drill a 3-16 or ⅛ in. hole. Cut a close thread the entire length of the rod. Procure 6 hexagonal nuts which must fit the rod snugly; also some washers. Fashion from small pieces of soft tool steel the two " knife blade " cutters shown in the illustration. The holes must be the same diameter as the rod, and are not to be tapped with threads.

The cutters will be improved by hardening and tempering. From a piece of iron or steel rod make two pins, as illustrated. Drill them firmly into the end holes. The two handles are similar to awl handles, with holes drilled in the ends to fit on to the pins.

This simple tool can be set up and used in cutting discs or washers with considerable accuracy when care is taken to bind the " knife blades " securely between the nuts and washers intended to keep them in place.

A WALL TENT.

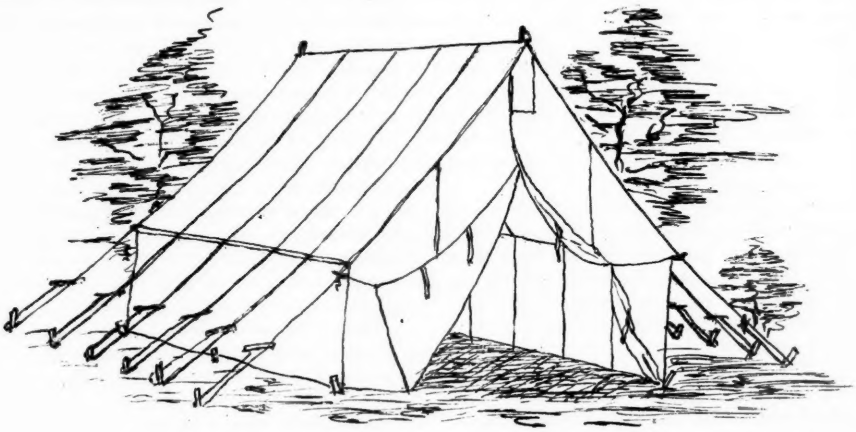
M. T. BROWNE.

The wall, or camping tent, possesses many advanvantages over the tent known as the A tent, inasmuch as the sides can be lifted in pleasant weather to allow a cross current of air through the tent, and yet can be quickly dropped and secured from the inside should storm arise. The size here described, 9 x 12 feet, will afford sleeping room for five persons, using single cot-beds.

The material used should not be lighter than 8-oz. duck; 12-oz. will be found best if extended camping is intended. Drilling is sometimes used, but the difference in the cost is not great enough to make it worth while to sacrifice the greater rain-resisting quality possessed by the duck, as well as the greater durability. If the tent is wanted only as a shelter for children, the lighter material will answer. The width of either duck or drilling is 29 or 30 in., the lap of the seams being varied from ½ in. to 1 in. depending on which width is used. About 60 yards will be needed.

There are five breadths in the sides and roof, each 8 yards long. These are cut and double stitched with a lap seam. For the ends cut four lengths 12 ft. 3 in. long. Sew two together with double stitched lap seams. Lay flat upon the floor and make a mark on one edge 3 ft. 1½ in. from the end; on the opposite edge 9 ft. 1½ in. from the same end, and with a straight edge or blue chalk line, connect the two points. A temporary chalk line can easily be made by chalking a piece of strong twine. Cut along this line, and by placing the long edges together one complete end is obtained. Repeating the operation will give the other end, the width being several inches greater than is required for the back.

The counter seam of the back is made the same as with the others, the extra width being cut off at the short edges leaving enough for a 1-in. lap seam with sides and top, which should also be double stitched. Before stitching the ends to the sides and top, however, measure the latter, and where the sides and roof meet the cloth is folded on itself, making what might be termed a pleat 2 in. wide and double stitched, with the stitching quite close together. This is done on each side, forming a lap in which are worked the holes for the guy-ropes. These holes are located one at each seam and the corners, but are not made until all stitching is completed.



The center seam of the front end is sewed at the top for only 1 ft. and allowing an inch on the outer edges for the seams there, the rest of the spare width is used for a lap for the entrance, so that when closed one side will close over the other from 6 to 8 in. Pieces of strong tape 9 in. long, are sewed to either side of the entrance on the inside, and used to tie them together. The front is then sewed to the sides and top, the lap of the latter being on the outside at both ends.

A hem is then made around the bottom about 1½ in. wide and strongly stitched. Holes for tie ropes are also worked in this hem at each corner, one in the center of each side; one in the center of the back, and one in each corner of the entrance breadths. The preferable way to work these holes is to use galvanized iron rings, which are made for this purpose, and which any hardware dealer can order from wholesale houses.

The cloth is cut out to fit over the inside of the ring and then with a small sail needle and strong cotton twine the ring is over-sewed in place. Made in this way the

holes will never rip under any strain likely to be given them. They are frequently made without the rings and, if care is used to have close sewing, will be quite durable.

The poles are made after the tent is completed so that the lengths may be correct. Pole irons can be obtained of most hardware dealers and include two ferules with holes for the ridge pole, two rods for driving into the ends of the upright poles, and two ferules without holes for the latter. Spruce is the best wood to use for poles, being light and strong, but it may be necessary to round them by hand from square stock. They should be at least 2 in. in diameter and free from knots. Oak poles are stronger, but heavy, and weight is an object if long distances in the woods are to be attempted, The upright posts should be 9 ft. 4 in. long, or long enough to be sunk several inches into the ground without having the bottom of the tent more than just touch.

After the posts are made, the places where the iron rods in the upright posts pass through the ridge pole should be marked on the tent and pieces of cloth 6 in. square stitched on the inside. A hole is then cut and oversewed, to permit the rods to pass through, which they should for at least 1 in. No ring is used in these holes. The projecting rods are used to hold the ends of ropes, which in windy weather are sometimes needed to hold the tent from blowing over, especially when camping on sandy soil.

For a smaller tent 7 x 9½ ft. and 7t. high, with 3 ft. walls, about 34 yards of cloth would be needed. There would be four breadths in the sides 17 ft. long. and the ends would take three breadths at the back and two whole and two half breadths at the front.

SAFEGUARDS FOR WORKMEN.

The "Monitor" the official organ of the Belgian Government, has just published a decree prescribing the precautionary measures to be observed by owners of workshops to safeguard the health of the employes and to provide against accidents to them.

In the ordinary workshop which the decree is intended to cover, each workman must have a free space of 10 cubic yards. The shop must have a height of 3 yards and must be ventilated in a thoroughly sanitary way. Certain prescribed appartus must be used to supply fresh and draw out vitiated air. This apparatus must have at least a capacity of 30 cubic yards an hour for each workman. In manufacturing establishments where the work is unhealthful, the capacity of the apparatus for renewing the air must be at least 60 cubic yards per hour for each workman. This apparatus must be arranged so that it will not in any way discommode or interfere with the workmen employed within the establishment.

Workshops or manufacturing establishments existing and in full operation before the issuance of this decree, the various rooms or departments of which could not be changed to comply with it without great expense or stoppage of work while the arrangements were being perfected, are allowed to continue on condition that (1) the working personnel of the establishlishment shall not be increased; (2) no toxic or other unhealthful materials shall be manufactured; (3) owners of such manufacturing establishments must indicate to the proper authorities the nature of the work, the location and the number of workmen employed, as well as the reasons for asking the indulgence. This declaration must be made within the year following the publication of the decree.

The owners of all establishments shall provide against the escape of gas or the existence of odors, vapors or dust that might in any way affect the health of the workmen. All shops shall be conveniently and systematically lighted, so that the workmen may be enabled to follow their employment without danger to their sight. All necessary precautions shall be taken to keep the air pure and to avoid the overheating of shops. During the winter the workshops must be conveniently and sufficiently heated, and in summer provision must be made against high temperature. The heating or lighting apparatus must be placed so as not to discommode or injure the workmen by reason of its proximity.

The waste, residue, sweepings and other accumulations shall be removed daily and destroyed. In establishments where the work is unhealthful the workmen must not enter or leave the workshop in the same clothing worn during employment. A cloakroom, with washstands and other necessary accommodations, must be established for the use of the employes. The heads of manufacturing enterprises must prohibit the carrying or eating of food within rooms where toxic materials are being manufactured. The water used, whether it be for drinking, spraying, or manufacturing purposes, must be pure.

The decree contains further provisions to guard the workmen against the influences of vapors or odors of any kind and against accidents from machinery, and to assure the solidity of the buildings and the absolute security of everything pertaining to the place where workmen are employed. Particular attention is drawn to the safety of ladders, wells, and staircases, and to precautions against fire. The introduction of alcoholic stimulants into the workshops or any part or place accessory to them is absolutely forbidden.

In a word, every precaution is demanded that will in any way protect the health of the Belgian workmen or lessen their liability to injury. The solicitude of the Belgian Government for its working classes is to be highly commended, and the fruit of such devotion is evident in the disposition of the workmen and their tendency to remain with the same employers throughout their lives.

PHOTOGRAPHY.

MASKING NEGATIVES.

WILLIAM A. INGRAM.

Beginners too often make prints from the whole of each negative, regardless of the fact that a portion would in many cases make a more satisfactory picture although, of course, less in size. Even when a stand camera with focussing screen is used, the resulting photograph can generally be improved by discretionary trimming.

The writer recently saw a full length photograph taken by an amateur on a 5 x 7 plate, the wrong way of the plate. Technically speaking, the photograph left little to be desired, but considered from an artistic or even common sense point of view, it was absurd. The figure occupied about one-sixth of the plate. A mass of trees on one side and a baseball grandstand on the other, dwarfed the *raison d'etre* of the photograph into insignificance.

Had the print been trimmed to about 3 x 5 it would have been passable, but as it was, it could boast of nothing except size. Circumstances might have made the use of a 5 x 7 plate, where a 4 x 5 would have served, admissable, but the mistake should not have been perpetuated by printing from the whole of the plate. Such photographs may be all right from a plate or printing paper maker's point of view, but the artistic, and in some cases, the economical side of the matter should be considered.

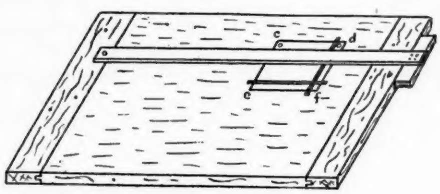


FIG. 1.

It is, therefore, desirable that some plan be adopted whereby the print may be reduced to the size most suitable for the display of its good qualities, and the diminution of its defects—if there are any.

This is best accomplished by masking, and the writer will, in the following lines, try to give the novice instructions and suggestions which will, as far as the practical part is concerned, enable him to make the best of his negative.

The artistic appearance of prints is improved in most cases by a narrow, plain margin between the photograph and mount. Furthermore, this margin permits the use of plain cards for mounting, thereby obviating the necessity of trimming prints to suit mounts.

This margin may be made in more than one way, and may be white or dark colored, or a combination of the two. The method of formation most generally applicable is that of masking, *i. e.*, covering with non-actinic paper, or some other opaque substance, parts of that the printing paper is not acted upon by the light in those parts.

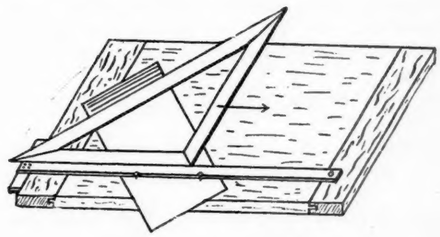


FIG. 2.

Masks for this purpose may be bought in a variety of sizes and shapes, but it is better to make one's own, for then the most suitable size can be obtained, which is impossible when one has only stock sizes on hand.

It is difficult to satisfactorily attach a loose cut-out mask with paste or any similar adhesive to the negative on account of the irregular expansion of the paper when moistened. For this reason cut-out masks have to be used loose. This is often a disadvantage because it means the finding of the mask each time a print is required, and there is always the probability of a loose mask moving during printing. So long as rectilinear sides are required the most satisfactory method is that of pasting strips of non-actinic paper along the sides of the negative. With a little practice this method of masking, as more fully described hereafter, takes less time than cutting the opening out of a piece of paper; and apart from the advantage of always having the negative ready for use, there is the fact that with glass negatives the strips act as a protection to the film.

Any kind of non-actinic paper may be used for the strips, so long as it is not too thick. The writer uses the black paper in which cyko and other kinds of printing paper is wrapped. Gummed passe partout binding is suitable if of dark color. This only needs moistening and it is ready for use.

METHOD OF PROCEDURE WITH FILM NEGATIVES.

Attach the film to the drawing board with two thumb tacks, using a tee square to insure the perpendicular lines on the negative being parallel to the sides of the

board. To facilitate this adjustment a piece of white paper may be placed beneath the negative. If passe partout binding is used, cut two pieces from the roll, one the length and the other the breadth of the negative. Each of these strips may be divided down the middle. Moisten the four strips, take one, and with the tee square as a guide affix it in position on the negative. Go around the other three sides in the same manner, moving the thumb tacks if necessary. One thing to remember is that there should not be less than two tacks in the film at the same time, which will prevent displacement. This arrangement is shown at Fig. 1, in which *c d e f* is the negative, and the shaded portions two strips already affixed. When the strips are affixed on the four sides, remove the thumb tacks, lay the negative on a smooth surface, film side down, and with a piece of soft rag press the back side of the negative to insure perfect adhesion of the strip. Place the negative under pressure until dry, when it may be trimmed with scissors, if any part of the film extends beyond the masking strips, and is now ready for printing from.

The white margin on the print can be trimmed to the desired width.

If ordinary black paper be used instead of passe partout, it may be cut into strips in the following manner:

Take a piece of paper about one inch wider than the length of the negative. Fasten this to the drawing board with thumb tacks, at the same time fastening the tee square, as shown at Fig. 2. With a set square as a cutting guide cut the paper into strips about a

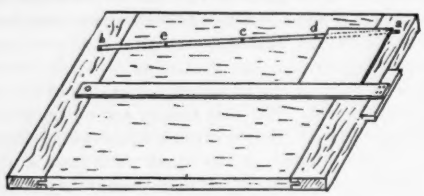


FIG. 3.

quarter of an inch wide. By moving the set square in the direction indicated by the arrow, the strips may be readily cut off. It is advantageous in cutting these strips not to sever them completely, except every four. They can then be pasted in batches of four, which takes less time than pasting them separately.

There are certain photographs on which a dark-colored border is more suitable than a white one. With film negatives this is very easily obtained. Trim the negative to the size required, and print with the printing paper extending one-quarter of an inch all around. The dark border so obtained can be trimmed to the desired width.

For those who like novelty a double border may be made on prints. The film is masked as described above and the mask and film trimmed, leaving only a narrow margin masked. A print from a negative so trimmed, with the paper so extending beyond the negative, will have a white margin next to the print, and outside of of that a dark one, which can be trimmed as desired.

MAKING GLASS NEGATIVES.

The procedure when masking glass negatives is not exactly the same as with films. Take a strip of passe partout binding about three inches longer than the sum of the four sides of the negative. Fasten one end of this strip with a thumb tack to a drawing board, gummed side upwards. Secure the other end in the same manner at such an angle that the strip will be parallel to the perpendicular lines on the image of the negative, when the latter is at the middle of the strip, and others at a distance apart as the sides of the negative require. The whole arrangement is shown at Fig. 3. Moisten the first division or the strip (*d a*) and with the tee square as a guide, which should be placed in position previons to moistening the strip, lay the negative on the moistened strip. When pressed into place cut off the portion of the strip without disturbing the position of the remainder, and follow the same procedure with the other three sides.

The negative is placed on the moistened strip—instead of the strip being placed on the negative—because it is much easier to handle the rigid negative than a piece of moistened paper.

When a black margin is required round a print from a glass negative, the easiest plan is to cut the printing paper about a quarter of an inch larger all around than the part of the negative to be printed. Cut a piece of non-actinic paper the size of the picture. Print from the negative first, and with a piece of paper on the print expose the margin behind a plate of glass in the printing frame.

It is not possible to make a double border on a print from a glass negative without cutting the latter with a diamond.

For temporary masking a glass negative four rubber bands may be used along the four sides. Care must, of course, be exercised on account of their flexibility. Rubber bands, cut like those used on fruit cans, only thinner, may be used when circular masks are required—"Photographic Times."

A detail of hardwood lumber production in the state of Michigan is the seasoning of a considerable portion of the clear white of the hard maple product so that the wood will be left white and not be in any way marred by sticker marks. This result is accomplished by drying the lumber on end under sheds. Maple lumber dried in this fashion commands a handsome premium over that seasoned in cross pile, as the sticker marks ordinarily showing on cross piled stock would be inimical to the production of the delicately hued maple furniture now so much in vogue.

PERSONAL RECOLLECTIONS OF THE ELECTRICAL INDUSTRY.

PROF. ELIHU THOMPSON.

Let us, in opening what will be but a brief outline of the development of the electrical industry in Lynn, look back to the conditions about 1876. In that year the Centennial Exposition was held in Philadelphia. This was the first large exposition in the United States and was in commemoration of the Declaration of Independence at that time, and of course can speak from a very intimate knowledge of things as they were. To give you some idea of the difference between that time and this, I have simply to mention that during that exposition no buildings were kept open at night; there were no means of lighting such buildings at night with any kind of ease or safety. All the power that distributed, nearly all the machinery the exposition was in one building—Machinery Hall—and the hall was traversed from the center in four directions by enormous shafts, with enormous belts and pulleys driving every piece of machinery in that hall. The engine,—a very large Corliss engine it was called—of 1400 horse power, was geared by great wooden cogs to a jack shaft below, and that jack shaft by bevel gear and belting, distributed power to the line shafting which ran the length of the building. This may give you some notion of the condition of power supply. There was a railway running through the grounds; of course it was a steam road; nothing else could have been thought of—nothing in the way of trolley cars; nothing in the way of electric railways.

Now, what did we find there in the way of electrical display? There were exhibits chiefly of telegraph instruments, and a small exhibit of telephones, but nobody believed that such an instrument was of any account, although it was used for the first time during the Centennial Exposition to transmit articulate speech over a line, and Lord Kelvin, who was then Sir William Thomsen, was one of the witnesses called to testify the fact that it did transmit speech. Even then it was two years before the telephone became recognized as a useful instrument of communication. Just try to imagine what the limitations were at a time when it was impossible to light any large building with any ease and without danger; perhaps with gas lights; perhaps with candles; perhaps with kerosene. I should say, however, that there were but two exhibits in that exposition which concerned electric lighting. One of these was the Gramme Electric Company's. The Gramme machine was made in Paris and was used to furnish current to a single arc light. A machine to work two lights, three, four or more lights, was unknown. There was a dynamo in the Gramme space (a little space, too), which drove as a motor another machine, and this motor worked a pump and ran a little water-fall. This was the first typical exhibit of the transmission of power by electricity in the United States, I think. It was the germ of a great industry. I was very naturally interested in all this—deeply interested. I had been building small dynamos, even before that time, and had experimented in a general way with electric lighting and so on, and I was much interested in seeing even these comparatively small exhibits.

In 1878, at the Paris Exposition, one of the Streets of Paris—the Place de l'Opera and the Avenue de l'Opera —was for the first time lighted by a system called the Jablochkoff. In this system two carbon pieces were put up parallel to each other and the electric current passed across a white insulating material between. This was kaolin. This lighting created a very great sensation. Each of the large globes contained a number of the Jablochkoff candles, as these double carbon sticks were called, because these only lasted about an hour or an hour and a quarter, and when one was burned down the next had to be switched on, and so the last in the globe. But they made a splendid effect for those times and attracted universal attention.

I was naturally interested, and went to Paris partly to see this exhibit. I made the trip abroad at that time to get all the knowledge I could in relation to this new electric development, but came away believing the Jablochkoff candle was not the thing for lighting; that it was beautiful but expensive, and not in the direction in which it was proper to work. On getting back I set about producing what was finally called the Thomson-Houston system, joining energies with Prof. Houston, who was, like myself, teaching in the Philadelphia High School at that time. We produced a dynamo and lamps. My first machine, intended for running an actual electric light, was built in 1876, but was very moderate in size, and very small in the matter of light. I could, by the use of a foot lathe, get a small arc light out of it. By working very hard and perspiring a great deal I could keep the light going for about a minute or so.

The above article was originally delivered by Prof. Thomson as an address before the body of apprentices of the General Electric Company in Lincoln Hall, West Lynn, Mass. The lecture was prepared in compliance with a request by Mr. Magnus W. Alexander, who is in general charge of the apprentices. It was stenographically reported as delivered, and as now first given out in printed form, has been fully and carefully revised by Prof. Thomson and adapted to the wider audience reached by the pages of this magazine.

In 1878, however, I built a machine which was capable of giving about 120 volts and 10 amperes. I made the patterns and put the machine together absolutely without any planing, having only a foot lathe at command. The armature was made up of cast-iron discs strung on a wooden hub or shaft, yet the machine certainly worked and was shown in operation at the Franklin Institute during the winter of 1878-79. It weighed about 350 pounds and was not a continuous-current dynamo but would give alternating currents. One could take from one end of the shaft continuous current, or direct current, and from the other end alternating current. More than that, one could get alternating current in two-phase relation. It was, in fact, a two-phase alternating-current machine, self-exciting, and the old machine has been preserved in the model collection at the Lynn works. This machine was in reality the beginning of our actual arc-lighting work on which was founded this industry.

In 1878 this machine was shown, as I have mentioned, at the Franklin Institute. It attracted the attention of Mr. Garrett, a typical Philadelphia Quaker, who was then the agent of the Brush Company, which was just beginning to put out some few arc lights. A few machines were in use, giving two to four arc lights to the machine. I must explain here that these machines worked in this way: whenever you wanted a light you ran a separate circuit out and back to the machine. They were what we may call single-arc multi-circuit machines. One set of armature coils fed to this line, another this, and so on, and for four lights you had to have four dynamos in one. The idea of putting lights one after the other in series was not developed at that time. Mr. Garrett asked if we could get up a four-light machine that would run these single-circuit lights, and he was told that we would try. "Well," he said, "if you want to try I will bear the expense and see how you come out." So I set to work at once. Evenings and whole nights were spent in getting information together and calculating out, as best I could, what that machine should be and how to build it in a small machine shop. I would not trust anybody to do the winding but myself. I personally wound the armature and the field, and did everything necessary of an electrical nature to ensure that nothing would go wrong.

It must be borne in mind that no armature winders were to be had in those days. It would have taken a great deal of superintendence to get any man to wind an armature correctly, or to do anything with insulated wire where the voltage was considerable. This machine was wound and run, and it gave four lights in four separate circuits. As the machine was being completed Mr. Garrett came in one day and said, "Can you not run those lights on one wire? I hear that the Brush Company is doing it." "Oh, yes," I said, "I can." We soon had them running on one wire, 20 amperes to each light. They were very large and beautiful arc lights, such as are not often seen nowadays. The lights ran all night in a bakery, and soon after a number were installed in a brewery, and so the business began. The bakery was fearfully hot in summer, and the temperature was about 140° in the room where the machine was running. We had to stay in it and so got baked as well as the bread and the arc machine. But somehow or other the machine stood up, and we stood up also.

Not long after the machine had been in operation another inquiry came from Mr. Garrett:—"Can you make that machine give half as much light per lamp and twice as many lamps, or can you put on more lamps and split the current up?" I said we could, for I had thought it all out before, believing it was coming; I did not wish to push him, but waited for him to push me in that respect, but the machine was all ready so that the circuit could be divided and made into what we called an eight-light 10-ampere series arc machine. For years after that the 10-ampere arc circuit was the standard, not only for ourselves, but for the other arc-light companies, with but one or two exceptions. The above conveys a general idea of how the Thomson-Houston arc system was started.

Mr. Garrett began to build machines after the first model and to sell them. One went into a brewery. An instance of something which happened there will show the way in which those new things were regarded at the time. We had established a seven-arc-light machine in this brewery, the proprietor, a good friend of ours, being willing to stake his lighting on our success. We were able to give him what he wanted, so put in the proper machinery and lighted this brewery. One night, for some reason or other, the hay in the loft above the stable which was part of the building took fire. It was thought somebody had been smoking there. The engineer at once shut down the lights, but the proprietor said, "No! No! Keep the lights on; I want to get the horses out." But when the firemen came, being unused to such lights, they played the hose on them and could not put them out. They were astonished to find that the globes could be full of water and that the light was still burning under water. Thus they learned that the electric light was different from other lights. There is no doubt in my mind that the fact that the electric light was kept going during the fire saved the building, because it enabled the firemen to work, and the only damage was in the upper story, in the malt room. The lights were run for a week or so afterwards with the wire lying across the burned portion of the building, so to speak. The circuit was passed through this burned portion and still ran the lights. I mention this as an incident of the early days, when the nature of electric lighting was still little known.

It required, as you may well believe, a considerable amount of courage to start an enterprise of this kind; not knowing what market there might be for electrical apparatus. It required that we, as it were, should prejudge the future. But it seemed as if an

era was opening in which electricity should have a great part—at least, so it seemed to me—and shortly afterwards a company was organized to begin operations in New Britain, Conn., and it was called the American Electric Company. It was formed for the exploitation of the system which we had been developing, and it carried on the work there for a year or two. The management was not very satisfactory at the start—was not pushing, not energetic—and the work dragged; but we kept at it and kept developing new things and perfecting our arrangements so that by the time the beginning of 1882 came there was a 25-light arc machine in existence and a number of appliances that made the system a very workable one—regulators, etc. In other words, we had, during this time of what one might call indifferent business management, got everything in good shape so that we could make a creditable effect with our arc-lighting system, when a better business outlook presented. I may say here that our arc-lighting system was the thing we began with, and that alone—simply a dynamo, regulators and arc lights. In 1882 our lights were shown in Boston for the first time.

Just at that time it happened that two or three gentlemen of Lynn, Mr. Henry A. Pevear, the first president of the Thomson-Houston Electric Company in Lynn, Mr. Silas A. Barton, the business manager, and a few others, were thinking of starting a little local electric-lighting company for supplying electric light to stores on Market street and thereabout. They happened to see our lights which had been put up in Boston, and which were being run by a company that was really only a stock-jobbing affair. This company was using one of our lighting machines as its own. But the promoters did not remove the nameplate from the machine, as it happened, and Mr. Pevear and Mr. Barton saw that the American Electric Company of New Britain Conn., were the makers, and took a train for New Britain to find out whether apparatus of that kind could be purchased. They appeared in New Britain one day in 1882. I was there, as was also Mr. E. W. Rice, now of Schenectady, and at present one of the vice-presidents of the General Electric Company, and we received them. We told them we did not know whether we could furnish them this apparatus or not. The majority of our stock had been bought out by the Brush Company of Cleveland, and we did not know whether or not they might try to shut us up. "Well," they said, "can't we buy what the Brush Company have bought?" "Possibly you may," we said. To make a long story short, negotiations were begun, and by the fall of the year 1882 the Lynn syndicate had purchased from the Brush Company such stock as was held by the Brush company. At once the Lynn management set to work with great vigor to make up for lost time. I must give all praise to the energy and push of the Lynn management at that time. It came into the matter with courage and determination to make the enterprise succeed. It ran the shop in New Britain for about a year while factory "A" was being built in Lynn. As soon as this was built we were to pick up everything and leave New Britain and come to Lynn, all of which occurred in the fall of 1883. So the first appearance of this electrical industry in Lynn was in the fall of 1883.

We then had only factory "A." The lower floor we had for the heavy work, such as dynamos, etc.; the upper floor was for lamps, and the middle floor for development work, pattern work and drafting. Everything was packed into factory "A," and Mr. Pevear thought—this is a story which he laughs about nowadays—that we should not need all of this building. He said: "Well, this business may not need the whole of factory 'A,' but anyhow the upper floor can be used for drying skins." It was but a few months before not only did we want all the floors there were in "A," but more room. "A" was loaded down from cellar to roof with all sorts of machines packed in closely everywhere, until it became doubtful whether the floors would withstand the weight, and I remember calling Mr. Baker's attention at one time to the floor weakening in "A" on account of overload. That was later on. But in these early days that was the condition—almost a serious risk from the weight there was in that building. This soon led, in 1886, to the building of factory "B," which gave considerable relief. Then we thought we had a great deal of room. It was not very long, however, before that building filled up, too. The top floor was the incandescent lamp factory, the middle floor the pattern shop, model room and office, and the lower floor was used for dynamo testing for some time. Factory "A" was given up to manufacturing parts almost entirely. Further on Factory "C" was built, and that was very soon filled; we kept on, as you know, and have now got pretty well along the alphabet to factory "R".

Now, this growth was of course not all the result of our original business of arc lights; it grew out of that business, but the Lynn management felt that we could not afford to tie ourselves down to any particular kind of application of electricity. We must take business of every kind that offered in the larger application of electricity. So, after the arc-lighting system was completed and in use, and so on, the next thing developed was incandescent lights, adapted to run on the arc-light circuits, to run in series with the arcs on the arc machine. Then came incandescent lights on continuous-potential circuits, as they are called. This was an entirely new business for us. It took some time to get under way—a great many things had to be done. And here I wish to say that while this was going on the Edison Company was devoting itself almost entirely to incandescent lights, and was building up a business at Schenectady—the Edison Machine Works. Later on, when the incandescent-lamp works had got well started, came alternating-current work, about 1886. Before that time everything had been direct current. Alternating current had very slight place—

and in speaking of alternating current I mean alternating currents sent over the line at high pressure with transformers to reduce the pressure for local lines. The beginning of the transformer work, which, as you know, forms a large portion of our work today, was in 1886.

But one of the greatest changes took place in 1887. This was the beginning of the railway work. Nearly all of the cars before that time throughout the country were drawn by horses. The Crescent Beach line, one of the first lines run by the Thomson-Houston Company, started in 1887. Very soon after that a line went over the Highlands through Lynn, the test being to see whether the trolley car could climb the heavy grade and make trips regularly without trouble. It was demonstrated to be feasible, and from that time the business of trolley-car introduction on electrical railways increased enormously.

Here I wish to speak of the spirit which existed in our organization. The management was always ready to recognize merit outside of the organization. There might be merit inside it, but the recognition of outside merit was just as ready as that of inside. It was found that Mr. Charles J. Van Depoele had been working on electrical apparatus in Chicago and had made considerable success in a way, without real financial return, and that Mr. Van Depoele was getting somewhat discouraged. We were quite ready to take Mr. Van Depoele under our wing and give him that encouragement which he needed. He had done considerable pioneer work which even at this day is found in electric railways. He was the originator of what is called "the under-running trolley"—that is, the little wheel on top of the wire—the over-running double trolley. I do not want to make these reminisences too tedious, but I wish to say that the railway business grew far more rapidly perhaps than almost any other business undertaken. Then came along meters and other devices in endless series. We know that we have continued the same proportion of growth and development right along, and of course we hope that we shall never see the end of the extension and development, and I do not think we shall.

Later came a large development in stationary motors and the use of cast steel for motors and dynamos. Previously, cast iron was the thing used in making all the frames of motors and dynamos. Cast steel could not be obtained. I remember distinctly writing to steel manufacturers around the country, asking if we could not get castings of such and such a shape of cast steel, and they said steel could not be cast that way. Finally, we had to put up our own steel foundries.

Now, in 1891, or about that time, came a great change. The Thomson-Houston Company here had achieved a great reputation and was a very active company, which had formerly been in the hands of the Brush Company, as I have told you, before the Lynn people became interested in it, had bought out the whole Brush Company—had turned the tables and bought out the Brush company and factory at Cleveland. Then shortly came the great consolidation which made the General Electric Company. "Why did such a consolidation appeal to the managers of the companies and others interested?" you may ask. Well, there was a large amount of money expended in competition with each other's business and in litigation, the outcome of which was uncertain, and so consolidation seemed the most natural thing in the world. One company was doing a large business in the same and different lines, and it was inevitable that they should severely compete, both in the market and in the courts. Business was impossible, in the best sense, when a great deal of money and talent which ought to go into dividends was being expended in legal combats or used in destructive warfare in the commercial market. Under these conditions the companies came together and the union of interests was perfected.

Mr. C. A. Coffin, now the president of the General Electric Company, had been active in the management from the start at Lynn, and was the head of the Thomson-Houston Company at the time of the consolidation. It is not too much to say that to his energy and resourcefulness much of the successful building up of the enterprise was due.

Now, what have we to look for in the future? Is this great growth that I have outlined—in the briefest way I must confess—going to go on? I think so. But what I wish to impress upon the young men in the electrical profession is that as you grow up you will find no really good result is ever obtained unless you are willing to exert yourself for it. In our early days we had lots of trouble, hard fights and plenty of difficulties to overcome obstacles or even prejudices against new things. Trolley lines were not adopted without such struggles. I recall being cross questioned in no very gentle way because I favored the introduction of the trolley line for Boston, as to whether people would not be killed or this disaster or that or the other calamity follow. I am happy to say that I was able to answer most of such inquiries and to satisfy those in control that there was not going to be any disaster following the introduction of the electric railway in the streets. In the early days, in 1882, as I have told you, we were bought out by the Brush Company. That was a time of discouragement. We did not know whether we were going to be shut up or go on with the business. But, fortunately, owing to the little accident of the Lynn people seeing what we were doing, the scale was turned and we began operations afresh with renewed courage, and of course with eventual success. It is indeed something to belong to, to be connected with an organization which has in so short a time grown to the magnitude and importance of our electrical industry.

THE INTERRUPTION OF PRIMARY CURRENTS IN RUHMKORFF COILS.

OSCAR N. DAME.

In the vibrating form of interrupter, whether core actuated or not, platinum is used for contact points because of its conductivity, hardness and freedom from smut or oxidization. The nearest approach to platinum for this purpose is coin silver, which is a slightly better conductor when oxidized than ordinarily, and much cheaper, but does not give lasting satisfaction, and is therefore used only on the simplest apparatus.

Iridium in combination with platinum makes an .deal contact metal. These points are extremely hard and are cast in " drops " of convenient size and ground flat when needed. For battery coils of the highest types, all vibrators are equipped with these points.

The amateur will readily understand that these points have to be flat at the point of contact so that the greatest amount of current may reach the primary of the core, for upon liberal saturation of the primary depends the generation of powerful lines of force cutting the secondary turns. Yet, on the other hand, on a vibrating spring only a few inches long there is a limit to the contact area of the pieces of platinum. Most interrupters have points of about No. 42 wire gauge.

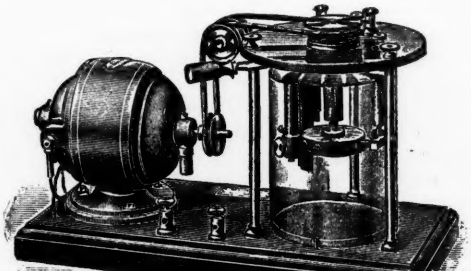


FIG. 1.

Condensers and their operation and construction have been so ably described in past issues of AMATEUR WORK that I will pass this necessity in vibrator design with only a suggestion to amateurs about to construct one for home use. As is well known, a condenser to meet all conditions of coil operation must be varied in capacity to meet the conditions of the primary and battery used, also the frequency of vibration. It is advisable to make a number of small condensers which may be connected together in multiple, series or compound to give certain capacities needed. Amateurs will understand that the condenser is built up to the proper capacity to cut the contact spark to a minimum, and that the addition of more capacity will prove too much for the coil, thereby weakening and shortening the length of the secondary discharge. It will be seen, therefore, that there must be some sparking at the make or break points, or else the secondary discharge will fall short of maximum, and this condition of affairs furnishes plenty of opportunity for experimental condenser construction.

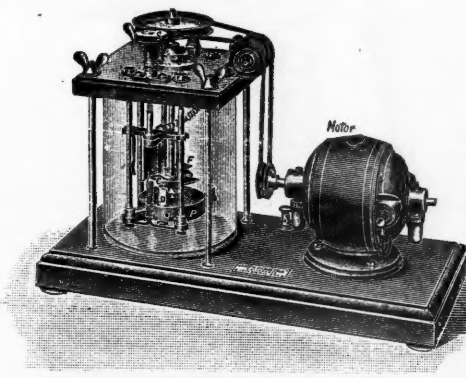


FIG 2.

Then, again, it will be observed that when the secondary spark balls are separated the maximum limit, the sparking at the contact points will be heavier than when the same coil is operated with the same primary battery and the spark balls closed to a fraction of an inch.

The vibrating interrupter admirably serves its purpose for small coil operation, and the cost of construction will not be great. But the amateur soon discovers that there are superior methods of interruption which bring out more of the spark value of the coil at but little additional expense.

First among other types of interrupters is the rotary, illustrated in Fig. 1. A large commutator is rotated between two carbon or copper flexible brushes, and as the insulated part of the commuter meets and passes the brushes, an interruption of the primary current takes place. Often times this commutator and brushes are immersed in alcohol or kerosene, which prevents sparking at the make and break. Condensers are used

with this type, to absorb the extra self-induced primary current, as in styles previously mentioned.

Early experimenters in coil work found mercury a very appropriate medium for interrupting electric currents. Being liquid and an excellent conductor, an iron needle or rod could be immersed and removed up to 1000 times a minute by means of the simplest of mechanism, and with motor attachment to increase the speed, interruptions as high as 3500 were obtained. Alcohol or thin oil in the mercury jar, prevented undue spattering and confined the spark at the make and break.

Another type consisted of a disc of steel, rotated at high speed and the disc being cut away at one edge for a short distance made an interruption every revolution. Many interrupters of this type are in service today in England, where it was first introduced.

Fig. 8.

A third type of interrupter is based on the principles of the Archimedian screw. Turn to the pages in Deschanel's or Avery's Physics devoted to the Archimedian screw and note how readily this device may be installed for interrupter work. Rotation of the screw lifts the liquid from the bottom, up through the spiral turns to the top, where it falls to the trough again to be lifted. Mercury passes through the spiral as readily as water. It may cause the interruption by being dropped or forced upon a vane or blade of metal, or may complete a circuit by dashing its discharge against the mercury issuing from another pump. This seems to be the most feasible type of mercury interrupter in use today. In the X-ray laboratory, especially where tubes are being exhausted, it plays an important part. These mercury interrupters are used with all voltages up to 110 with little perceptible heating.

A great many operators now use the Wehnelt break with results which are extremely satisfactory. Owing to the large number of breaks (1000 or 10,000 or more per minute) the amount of energy delivered by the Secondary is greatly in excess of that possible with any other interrupter save the Caldwell form or a high speed mercury device; in making Skiagraphs, therefore, the time of exposure should be greatly diminished assuming that, other things being equal, the X-rays are proportional to the energy output per unit of time. That this is the case is proved by the results which have come to us. X-ray pictures through the body formerly requiring 15 to 36 minutes are now secured with exposures of from two to five minutes. Fluroroscopic images do not depend upon the energy output so much as upon the quality of the ray, and hence are not necessarily better with an Electrolytic than with an ordinary break except that absolute evenness and steadiness is secured with the former, whereas with the latter, unless the rate of interruption is high, there is flickering.

A Wehnelt interrupter consists essentially of a small surface (3 to 4 sq. millimeters) platinum anode and a large surface (200 or 300 sq. centimeters) lead kathode immersed in dilute H_2SO_4. If joined in series with the primary of an induction coil and sufficient E. M. F. exceedingly rapid breaks take place at the platinum surface. These breaks are probably due to the sudden formation of an envelope of nonconducting gas about the platinum surface; their frequency varies directly as the E. M. F. employed and inversely as the area of platinum. In practice at least 40 volts at the terminals of the interrupter must be used to obtain good results; as on large coils from one to four amperes will be required, this causes a heating loss of 40 to 160 watts so that the interrupter is theoretically not efficient. The rate of interruption is also seriously affected by the heating of the dilute acid; if heating goes too far, so that the fluid becomes actually warm to the touch the interruptions seem to lose their sharpness and will often fail altogether. This shows the necessity of keeping the fluid at a uniform and reasonably low temperature.

When using a Wehnelt interrupter no condenser is required; this reduces the cost of a coil somewhat.

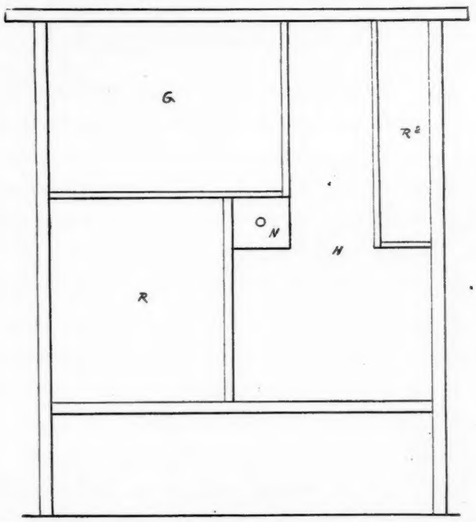
As the interruptions lose all sharpness when lead is made the anode and platinum the kathode this form of break permits the running of induction coils on alternating circuits, only positive impulses giving secondary discharges. There is, however, considerable corrosion of the platinum and its holder on the negative impulse thus making maintenance expensive, and it is, therefore, not advised for alternating use except when no other method of running is possible.

Phospher bronze is an alloy of phospher, tin and copper, containing usually 0.053 to 0.76 per cent phosphorus and four to ten per cent tin, balance copper. It is as tough as wrought iron, more ductile than copper and is capable of withstanding great wear.

A GRAMAPHONE CABINET.

JOHN F. ADAMS.

A gramaphone is a rather inconvenient instrument to handle, and without a suitable cabinet, is not convenient to put away when through using. The cabinet here described will contain all the parts, including horn, records, needles and the gramaphone. The compartment for the records is large enough to contain a pasteboard box with index holding 50 ten inch records and there is also an additional place for a few twelve-inch records. As the sizes of the different gramaphones vary a little, the dimensions of the compartment for storing it should be determined before cutting the pieces for the partitions so that the space will be of suitable size.



The top is 28 x 22 in. and ⅞ in. thick. The two sides are 29½ x 18 in. and ¾ in. thick and the lower surface is 5¾ in. above the floor. The partitions are all ½ in. thick. The board dividing the spaces *G* and R is 14 in. long and 17 in. wide. That between *G* and *H* 10 in. long and 17 in. wide. Between *R* and *H* the board is 12 x 17 in. These three boards, as well as the top and sides, will have to be glued up from the narrower pieces. They are then nailed in position with 1½ in. wire nails of small gauge.

The board between B^2 and *H* is 13 x 17 in., and the lower board under B_2 is 17 in. long and 3½ in. wide, the grain of the board running from front to back. The drawer, *H*, is 3¼ x 2¾ in. and 12 in. long, outside dimensions, and made of stock ¼ in. thick, except the ends, which should be ½ in. thick. Pieces of ¼ in. stock, for the right and under side are cut out and nailed together at the edges joining and then nailed to the partitions. The front and end pieces of the drawer is made to project over these pieces and conceal them when the drawer is closed.

Two doors 23 x 11½ in. are made with panels, if the maker cares to put in the additional work required to make them, or may be of plain boards, with or without cleats at each end. Without cleats there is the liability of warping, unless the stock is thoroughly seasoned and all wind planed out.

The hinges can be of the usual kind, hung in the jamb, or ornamental brass hinges hung outside can be used to good effect if the wood is to be finished dark.

"WIRELESS" COMMUNICATION AMONG SAVAGES.

Many explorers have commented on the speed with which news travels among savage tribes. A curious observation as to a possible solution of the problem of their methods has been made by the Rev. A. Rideout. who, as a missionary among the Basutos, has noticed their method of sending messages from village to village by means of a signal drum or gourd. This gourd, covered with the dried and stretched skin of a kid gives out a sound which travels and can be heard at distances of from five to eight miles. The transmission and reception of messages on these drums is entrusted to special corps of signallers, some one of whom is always on duty, and who beat on the message in what is practically a Morse alphabet. "On hearing the message," says Mr. Rideout, "the signaller can always tell whether it is for his chief or for some distant village, and delivers it verbally or sends it on accordingly, and it is thus carried on with surprising rapidity from one village to another till it reaches its destination. King Lerothodi granted me the privilege of sending messages to our missionary workers by his great telegraph system, and never have I known a message sent by it to fail to reach the person for whom it was intended in its proper form. All that took place in the Boer war, victories and reverses in the transvaal and Orange Free State were known to us by gourd line message hours before the news ever reached us by field telegraph. The natives guarded the secret of their code carefully. To my knowledge, messages have been sent a thousand miles by means of it." This is probably one of the earliest forms of wireless telegraphy.

Kerosene came into general use about 1850. It was first called coal oil. It was also known as mineral oil and petroleum oil.

AMATEUR WORK.

DRAPER PUBLISHING CO., Publishers,

88 Broad St., Room 522, Boston, Mass.

A Monthly Magazine of the Useful Arts and Sciences. Published on the first of each month for the benefit and instruction of the amateur worker.

Subscription rates for the United States, Canada, Mexico, Cuba, Porto Rico, $1.00 per year.

Single copies of back numbers, 10 cents each.

TO ADVERTISERS.

New advertisments, or changes, intended for a particular ssue, must be received at this office on or before the 10th. of the previous month.

Entered at the Post Office, Boston, as second class mail matter, Jan. 14, 1902.

AUGUST, 1905.

To impress upon the youth and young man the necessity of utilizing to the utmost every opportunity for educational advancement is now, as it always has been and is likely to continue, a well nigh impossible task. Pleasure, rather than profit, is the leading desire at this period of life, the time when the mind is most receptive of new impressions and ideas and when proper cultivation would produce most beneficial results in both a practical and intellectual way.

Is it always to be thus? There are indications in various sections of the country that educators and also industrial leaders are awakening to the importance of changes in the present educational methods, whereby the youth will be given practical instruction along industrial lines, in this way overcoming the lack of incentiye on the part of the youth himself. This will probably meet with opposition from labor unions, the leaders and members of which, with few exceptions, have yet to learn that fundamental principle of industrial economics:—That educated and skilled labor will always command a higher wage than will the unlikled and uneducated, and that the large problem is to remove the competition of the latter class by universal education.

The magnificent results in this line now being realized in Germany, and the rapid progress of that country in industrial supremacy, affords ample evidence, if any be required, that youth should be given to industrial education. The relatively small proportion who have the means and the inclination for higher technical education, are amply provided for. It is those who now terminate their school life with the grammar or high school, totally lacking in the skill for any special work, that need consideration and it is encouraging to note that the subject is likely to be given the attention which its importance demands.

The "Model" telephone which we briefly announced in the previous number, is rapidly nearing completion, so that deliveries can be made at an early date. We can say without hesitation that this telephone will, so far as efficiency goes, be in every way satisfactory. It will operate over a line of at least 150 yards, and the number of inquiries already received leads us to believe that it will be one of our most popular premiums. Many of our readers have places about the house which could be connected with a pair of these instruments, thus saving many steps. It would take but little time to get the four new subscribers necessary to securing a pair. Try it.

Have you the complete set of bound volumes? If not, do not delay your order until it is too late.

The first five numbers of Vol. I, November, 1901 to March, 1902, are out of print, and no new orders can be received for same.

Most metals, when in a molten state, are capable of dissolving at least small proportions of carbon, which, in general, leads to a deterioration in metallicity, except in the case of iron, which, by the addition of a small percentage of carbon, gains in elasticity and tensile strength, with little loss of plasticity.

FIFTEEN-FOOT DUCK BOAT.

By Courtesy of the Brooks Boat Mfg. Co.

The following materials are required:

OAK, MAPLE OR ASH.

One piece 32 in. long, 5 in. wide, 1¾ in. thick for stems.

Eighteen running feet 1¼ in. wide and ⅝ in. thick for floor timbers.

Fifty-five running feet ⅝ in. half-round for fender.

Two running feet 1 in. quarter-round for corners of coaming.

Sixteen running feet 3½ in. wide, 1 in. thick for knees.

HARDWARE, ETC.

One pound 6 penny wire nails; one pound 1¼ in. wire brads; one pound 1½ in. wire brads; one pound 1 in. wire nails.

Six doz. 1 in. No. 12 screws; six doz. 1¼ in. No. 12 screws. One ounce of 2 ounce tacks. Four yards of drilling.

The duck boat may be built anywhere and requires no preparation, but those who intend building a number of boats should have a suitable shop. A light, warm shop makes boat building pleasant. On one side have a workbench with a plank top about 2 ft. 8 in. high and 16 ft. long. Have a carpenter's vise at the left hand end.

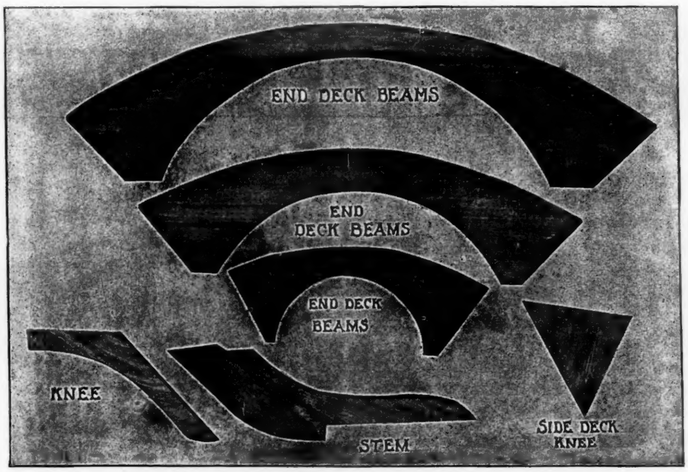


FIG. 1.

PINE, CEDAR OR CYPRESS.

Two pieces 15 feet long, 13½ in. wide, ¾ in. thick for bottom or, if more convenient, get 3 pieces 9 in. wide.

Two pieces 16 feet long, 14 inches wide ⅜ in. thick for side plank, or four pieces 8 feet long, 9 in. wide may be spliced.

One piece 16 feet long, 14 in. wide, ⅜ in. thick for deck. This may be in 2 pieces 7 in. wide.

Two pieces 8 feet long, 6 in. wide, ⅝ in. thick for side coaming.

Two pieces 2 ft. long, 8 in. wide, ⅝ in. thick for end coaming,

The tools required to build the duck boat are a claw hammer, saw, draw shave, block plane, smooth plane, half inch chisel, brace, No. 4 German bit, countersink, screwdriver and brad awl.

INSTRUCTIONS.

When patterns do not intersect they may be cut apart for convenience.

Paper patterns for this boat are to be obtained of the Brooks Boat Mfg. Co., Bay City, Mich., and those not fa-

miliar with boat construction will find them a great convenience.

Lay the pattern on the material, place it so it will cut to the greatest advantage and not waste lumber, fasten pattern securely with a few tacks and then prick through with an awl on lines of patterns. When the lines curve make the prick marks close; follow outside of the line, which gives you room to dress with a plane after the piece is cut out; take pattern off and drive some small nails in marks made by awl. Now take a thin strip or batten and bend it up to nails, then mark in the line. This will reproduce the same lines on the lumber that are on the pattern. This method saves the pattern from being destroyed. As the ends of this boat are exactly alike, patterns of the pieces of one only are given; therefore after making one piece, use it for a pattern to make a duplicate for opposite end or side. If the local mill has a band or jig saw, most of the work may be saved by marking out the deck beams, knees and stems and having them cut to shape. When this cannot be done cut the pieces to shape with a keyhole saw and a drawshave.

Before driving a nail, punch a hole with a bradawl through the outside piece only. Before putting in a screw, first bore with a No. 4 German bit, then slightly countersink for the head of the screw.

The pattern shows one side only. Use two or three boards $\frac{3}{4}$ in. thick. In illustration No. 1 three boards are used, the line in center being the center line marked on the board. The boards may be put together with a square seam and calked, or with a rabbeted seam, which is the better way for the mechanic. Make the rabbet $\frac{3}{4}$ in. wide, and one half the thickness of the plank. Put together with lead paint and fasten with $\frac{7}{8}$ in. clout nails, holding the clinchiron against nails. Stagger the nails along the joint to prevent splitting. The first-mentioned method of square seams is the best for the amateur. See that the edges of the boards

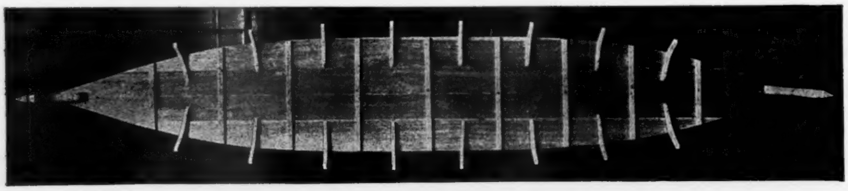


FIG. 2.

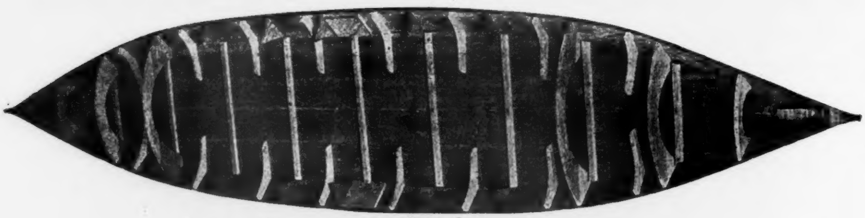


FIG. 3.

FIG. 4.

FIG. 5.

fit squarely together and are planed smooth. Cut the floor timbers into their proper lengths and fasten the bottom to them with 1 in. screws, putting the screws through the bottom first into floor timbers. The bottom is now square and twice the width of pattern. Mark a center line from end to end on outside of bottom; lay the center or dotted line of pattern to the line so marked and prick in the outside line. Now turn the pattern over and place to center line. Prick in the outside line by putting awl in the same holes. This gives entire bottom.

To make the stems, cut out of oak 1⅞ in. thick. The rabbet line, as shown on patterns, is a line which is a furrow or trough cut in to receive the ends of the plank for the purpose of bringing them flush. This rabbet is cut in ⅜ of an in. deep and is beveled so as to receive the plank fair. Bevel in from rabbet line one way and from inner edge of stem, as shown in illustration. Bevel stem from rabbet to outer edge so as to leave edge ⅜ in. thick. Fasten stems to bottom with three 1¼ in. screws and if necessary, draw tight with two or three six penny wire nails. Cut out the knees. There are sixteen, all shaped by one pattern. Fasten them at their places to bottom with two 1¼ in. screws. You will note in illustration No. 2, that knees are swung so as to be square with edge at spot where they are located. Cut deck beams out of ⅞ in. pine or cypress and fasten at their station with a 1¼ in. brad at each end through bottom.

The side pieces, plank, may be in one or two pieces, as shown in illustration No. 3. When two pieces are used the butt or joint comes in center and is reinforced with a six in. piece of the same material, covering butt on inside and fastened with six or eight ⅞ in. screws or ⅞ in. clout nails. It is better to make the side plank in one piece, if lumber wide enough can be obtained. Before fastening on sides place the bottom flat on the work bench, put a two inch block under each end and fasten the middle down to bench. This will give about the proper sheer to the bottom so that the sides will go on easily.

Fasten the side plank on. Commencing at one end, fasten to stem with three 1 in. wire nails and to knees with three 1 in. wire nails, and to deck beams with two 1¼ in. screws. Fasten lower edge of sides to bottom with six penny wire casing nails, 1½ in. apart. Cut out side deck knees 1, 2, 3. There will be four of Nos. 1 and 2 and two of No. 3. No. 3 goes in middle of boat, then 2 and 1 towards ends, as shown on pattern of side plank and in illustration No. 3. Fasten to deck beams with 1¼ in. brads.

When deck is on, set nail and smooth off with coarse sandpaper and put on drilling. Stretch on smooth and tack to inner and outer edge of deck. Illustration No. 4 shows coaming in before deck is finished. The drilling should be put on before the coaming is fastened in. Cut coamings and fasten end pieces to deck beams with four 1¼ in. screws. Fasten side pieces by putting a piece of 1 in. quarter-round at each corner and fastening both ways with three 1¼ in. screws. Round off the outer corners of coaming. Fasten bottom of coaming to edge of deck with 1¼ in. brads. Put a piece of ⅜ half-round for fender, from stem to stem. This will cover the seam between deck and sides and also cover the tack heads. Put a piece of ⅞ in. quarter round around outside of coaming on deck, fastening the quarter-round with 1¼ in. brads.

If the seams of the bottom have not been rabbeted, calk them with a light thread of calking cotton, using a small calking iron or a blunt putty knife will do. Be careful not to drive the cotton too hard as it swells when boat is in the water. Give the boat two good coats of lead paint. working well into all the seam joints. Should it be desired to rig boat for oars, a couple of iron outriggers similar to illustration may be fastened to coaming. For the benefit of the amateur we will repeat: Before driving a nail, punch a hole with a brad awl through the outside piece. Before putting in a screw, first bore with a No. 4 German bit, then countersink for screw head.

SLEEPING SICKNESS.

Col. David Bruce who, in Uganda and elsewhere has been inquiring into the cause, effect and distribution of "sleeping sickness," addressed a meeting at the Royal Institute of Public Health on the subject. Col. Bruce said that in certain parts of the country where the disease had broken out some time between 1896 and 1901 it had in a short time reduced a populous and richly cultivated country to a depopulated wilderness. Sleeping sickness was essentially a disturbance of the functions of the brain. A patient might go about doing his ordinary work for years without his friends noticing that there was anything the matter. But gradually a slight change in his demeanor became evident; he was less inclined to exert himself; he lay about more during the day; and at last his intimates saw that he had the first symptoms of that absolutely fatal disease. His investigations had led him to believe that probably the disease was introduced from the Congo; that it was caused by the entrance into the blood of a protozoal parasite, and that the infection was carried from the sick to the healthy by a species of fly. Where there was no fly there was no sleeping sickness. In other words, they were dealing with a human tsetse fly disease. Sleeping sickness was found to have a very peculiar distribution. It was restricted to the numerous islands that dot the northern part of the Victoria Nyanza and to a narrow belt of country a few miles wide skirting the shores of the lake, but only in localities where there was forest with high trees and dense undergrowth.

AMMONIA; THE PROCESS OF MANUFACTURE.

Abstract of a paper read at a meeting of the Cold Storage and Ice Association, London, Eng., by Mr. Charles Page.

You are, no doubt, all familiar with the form of a gas retort in which coal is distilled for the production of what, in spite of electricity, may still be described as our chief artificial illuminant. From this retort the crude gas and tar ascend by a pipe, which passes into the hydraulic main, a sealed trough containing water, where the tar is separated from the gas. The latter, still in the crude state, is led away by pipes, to go through the various processes of purification necessary to make it a good and innocuous illuminant. Of the impurities, ammonia forms an important part, and in order to remove it the gas is passed through a scrubber, of which the most common form is a series of towers containing coke, through which a constant flow of water is maintained. As water readily absorbs ammonia, this impurity of gas is given up during the passage of the crude gas through the scrubber.

The water of the last of the series of towers, where very little ammonia is present, is used over again in the rest of the series until it contains about two per cent of ammonia. This ammoniated water, termed commercially gas liquor, invariably contains other impurities of coal gas, including sulphur and a small percentage of tar, which will have passed over with the gas from the hydraulic main. This gas liquor, together with the tar and the water from the hydraulic main (which will also contain ammonia), is collected in suitable receivers, most commonly underground tanks, where the tar sinks to the bottom, and the two can be separated subsequently by suitably arranged pumps.

At this point it would be interesting to note some of the commercial aspects of the production of ammonia. You will have remarked that ammonia is a by-product of the manufacture of gas, and when I tell you that a ton of coal will yield only about four to five pounds of pure ammonia you will see at once that it could not be produced and sold at the current market price as a main product. Coals of different origin vary greatly in yield of gas and its by-products, but taking the average yield of the coal used for gas-making in this country, it may be stated roughly that one ton of coal distilled by the most modern process, will yield about 11,000 cubic feet of gas, 200 to 250 pounds of tar, four to five pounds of pure ammonia, twenty to twenty-two pounds of sulphur, and thirteen to fifteen hundred weight of coke.

The by-products, or residuals, as they are termed by gas engineers, form a very important part of the industry of gas-making, and naturally great attention is paid to them, both in the selection of coal and in the methods of distillation. So important a part do these residuals play, that in some places, where coal is cheap and the production of gas large—the town of Sheffield, for instance—the total cost of the coal is covered by the yield of the residuals. Those of you who are share-holders in gas undertakings will realize, therefore, what an effect the price of residuals, as the by-products are termed, will have upon your dividends.

And for all of us the point is an interesting one, as it exemplifies how one industry is dependent upon another in a way which by no means appears upon the surface. You would not think that the price you pay for the ammonia which you use for refrigeration has any sort of connection with the dress which your wife wears, which is dyed by a tar product possibly made from the same ton of coal as some of your ammonia, but it is an economic fact none the less.

I would mention here that ammonia is also produced in the processes of making coke for iron smelting and of distillation of shale for the manufacture of oil as carried on in Scotland.

These are important sources of ammonia, and the methods of obtaining it are much the same as those I have described. Water is the vehicle, and what may be termed the raw material, which is used by the manufacturers of ammonia, is gas liquor, containing only a small percentage of ammonia.

To return to the process of manufacture. I have shown you how gas liquor containing about 2 per cent of ammonia is obtained. This ammonia is partly free and partly fixed—that is, part of it will evaporate, and it is this portion which gives the strong odor to the liquor, while part of it is held in solution by the sulphur which also comes over with the other impurities of the crude gas. The relative portions of free and fixed ammonia vary according to the nature of the coal used and the condition of distillation. This gas liquor contains numerous impurities, which would go over with the ammonia if the latter were simply distilled, and it is the business of the mauufacturers of anhydrous ammonia to get rid of these impurities, and so to produce an ammonia which will contain nothing which will have any injurious effect upon the most sensitive parts of a refrigerator plant, and which will be easy of compression and rapid of expansion. The surest method of accomplishing this is to make first a solution of this salt and drive the ammonia off again before drying and compressing it.

This brings us to the manufacture of sulphate of ammonia, a perfectly odorless salt, containing about 25 per cent of ammonia. In this process the gas liquor is passed into the top of a column, like a boiler placed on end, divided at intervals by plates which are perforated in the center and at alternate sides, and the perforations are so guarded that the gas liquor rests

on each shelf to a certain regular depth before it can pass to the plate below. While the liquor thus descends from plate to plate through the tower, steam is admitted at the bottom and ascends through the center holes of the plate though the tower, (or, in some processes, in a separate tower to which the liquor is carried) milk of lime is introduced, and this sets free the fixed ammonia, which in like manner is carried up with the steam. The number of plates in the tower and the treatment by lime is governed by experience of the liquor being worked, and the outflow of water is tested from time to time to see that there be no waste of ammonia. The residue should not contain more than .002 per cent, or about one-thousandth part of ammonia which the gas liquor contained on entering the tower. The ammonia carried up by the steam is conducted by a pipe from the top of the tower to the saturator, a vessel containing sulphuric acid of the proper strength, which fixes the ammonia and forms sulphate of ammonia, precipitating it in the form of crystals, which are fished from the saturator and allowed to drain.

Having now imprisoned our very volatile gas in the form of sulphate of ammonia, it can be left exposed to the air for any period without detriment so long as the salt be kept fairly dry.

This, then, is the most convenient form in which ammonia can be transported, and it is in this form that several hundred thousand tons per annum are used for fertilizing purposes. But for our purpose we need the pure ammonia gas, and this is obtained by dissolving the sulphate of ammonia and adding milk of lime to it, which again sets the ammonia free. The solution is treated in much the same way as the gas liquor, but the resulting gas is naturally much more free from impurities than in the first process. In this process there is considerable loss of ammonia, for it is found that even when an excess of lime is used—by an excess I mean more than the quantity required chemically to combtne with the sulphuric acid and form sulphate of lime, which is the process by which the ammonia is set free—with an excess of acid and the employment of mechanical agitators it is impossible to recover all the ammonia. A yield of 90 per cent is in practical working considered a good yield.

This ammonia is now considered a very volatile gas, and throughout the remainder of the process great care has to be exercised to guard against loss by leaky joints, or accidents, or carelessness of workmen. It is first conducted to a condenser, where the gas is cooled, and then to purifiers and driers. In this stage of the process lime plays an important part, as it absorbs the moisture, while it has no affinity for ammonia. To ensure absolute dryness the ammonia gas is finally passed through a cooling tower which is itself refrigerated by means of anhydrous ammonia from the compressor, so that any remaining moisture is frozen out of the gas.

After the process of purifying and drying, the ammonia passes to the compressor, which works at a pressure of about 150 pounds, and from there it goes to a condenser, where it is contained until filled into cylinders for conveyance to the buyers.

A word about these cylinders, which form a very important and probably the most expensive part of the manufacturer's stock in trade, will not be without interest. They are made from tubes of toughened steel, and when new, after the valves are fitted, are subjected to a test by a hydraulic pressure of 1500 pounds to the square inch. They are thus absolutely safe even in the hottest climate when properly filled with anhydrous ammonia, but to insure this it is necessary that the quantity should not exceed five-eighths of the water capacity of the cylinder.—"National Engineer."

Some heroic work was recently accomplished in a burning coal mine at Edwardsville, Ill., when the miners concluded that their only salvation lay in cutting out the burning coal. This they did, sending the burning fuel to the surface in the mine cars. The mine workings were filled with gas, and the heat was almost unbearable, but the entire village depended for its existence on the operation of this one mine. With them it was a case of self-preservation, and they were found equal to the emergency, as they usually are when herculean tasks are to be performed in a mine, whether to save the lives of their fellow workers, or the property of their employers when it is in danger.

When melting babbitt metal care must be taken not to overheat it, or the more easily melted constituents partly evaporate, leaving the alloy in bad condition. Melt a small part first and gradually add to it until all is melted. Then skim off the top and the metal is ready to pour. Before pouring the metal wrap a sheet of smooth writing paper around the shaft or other journal to be babbitted, and secure it by winding a string spiral, in turns, half an inch apart. Then place in the bearing and pour the metal. The paper keeps the cold iron from too quickly chilling the babbitt and gives it a smooth surface, while the grooves made by the string make good oil conduits. It will be found, if this is properly done, the journals will fit the bearing nicely and will require no scraping.

The solid matter in ocean water is 2139 grains per gallon, and that in the Dead Sea about 19,700 grains per gallon. The amount of saline and other soluble material held in solution in salt lakes varies with the rainfall, some years it being greater than others. In stages of low water the quantity per gallon increases, and in stages of high water following heavy rains it becomes less.

A CHEAP NINE-INCH REFLECTOR.

M. A. AINSLEY.

III. Construction of the Polisher.

We have now arrived at the point where the worker will begin to appreciate the real difficulties of the work. Up to this point all has been fairly easy; but the beginner must not be discouraged if his early attempts at the construction of polishers are failures, and he must be prepared to exercise unlimited patience. The pleasure of seeing the wonders of the heavens through a telescope of his own construction will amply repay him for his time and trouble.

The pitch used, as before recommended, should be Swedish pitch, in 2 lb. boxes—about 2 lbs. will be required. Also we must obtain some rouge. I got mine in ¼ lb. packets through a jeweller, who specially ordered it for me, and it is important to get the very best that can be got. If there is any difficulty about it, an optician would probably be able to supply it. It is somewhat expensive—$2.50 the pound, or so—but ¼ lb. will be ample. An iron ladle to melt the pitch and an iron spoon to stir it are, of course, necessary, and an ample supply of turpentine.

There are two distinct methods that I have tried of making the polisher: One is to pour the pitch directly on the tool and stamp grooves in it to form the necessary facets. The other is to make the squares of pitch separately and mount them independently on the tool. I prefer the latter method, if only because a slight flaw in the polisher does not necessitate the renewal of the whole thing—local repairs being quite easy.

Now pitch is, as I have said, a good friend but a bad enemy. As I was told by an expert correspondent: "Stick to pitch—it will certainly stick to you," and "if it is a good friend, it does sometimes stick closer than a brother." But I am glad to say that there is one thing that pitch does not show any brotherly affection for, and that is blotting-paper. Provide, therefore, an ample supply of blotting-paper in sheets not less than 10 in. square, if possible. A large sheet of plate-glass or marble 14 in. square should be provided, and we shall require a stamper to form the square, and a frame of wood to retain the pitch till cool. The frame should be, for a 6 in. mirror, 40 in. square inside and 12 in. outside, the sides being therefore 1 in. broad, and it should be ⅝ in. deep. For a larger mirror it should, of course, be larger, the inside measurement being about 1 in. larger than the diameter of the mirror. This is to allow for a few extra squares in case any get broken. The stamper is made by screwing two flat pieces of wood, 12 in. x 1½ x ¼ in. to the sides of a rod 1 in. square and about 18 in. long. The ends of the rod may be rounded off to form handles, and the flat side pieces should project about ½ in. as shown in the figure, and have V-shaped edges. I append a rough sketch of the instrument, which will explain what I mean.

The hardness of the pitch is a matter of some importance, and authorities differ to a large extent. I found in my own case, that if a shilling, standing on its edge, left five complete impressions of the "mill" in one minute, it was about right; the temperature makes a difference, the pitch being harder when cold, so that the test should be carried out at the same temperature as that of the room in which it is proposed to work. I do not recommend the beginner to have his pitch any softer than I have indicated; it may be even a little harder.

The pitch having been melted as before directed (in my second letter), its hardness should be tested by pouring a little on a piece of glass; and turpentine should be added slowly till it is about right, the pitch being thoroughly and constantly stirred while the turpentine is added. If too soft it should be kept at the melting point and allowed to evaporate, when it will harden. But I did not find this necessary, as the pitch is now poured out steadily on to the slab till it has a depth rather less than that of the frame, say 5-16 in. Any impurities must be kept back with the iron spoon.

After it has cooled down a bit, but before it hardens—and this may be tested by touching it it with a blunt wooden point covered with wet blotting-paper—the frame may be removed. This is quite easy if the blotting-paper is used, but not so easy if it is omitted—and a cake of pitch 10 in. square by 5-16, is left.

We now bring the stamper into action. A series of grooves are stamped out parallel with one side of the pitch cake. Each groove is stamped twice, the following edge of the stamper being placed in the groove just vacated by the leading edge. In this way the squares are all kept of the same size. A similar set of grooves at right angles to the first are stamped and the pitch cake is then divided in 1 in. squares separated by ¼ in. grooves. It is protected from dust without, of course, being touched, and left to get thoroughly cold. When cold it is slid to the edge of the glass slab and broken into squares very much as if it were toffee or chocolate. After a little practice this can be done without splintering the squares if care is taken; but as there are plenty of squares made, the loss of a few does not matter. The hands and pitch must be kept wet, to avoid the latter sticking to the fingers; and the pitch squares, when broken off, should be placed in a basin of cold water till required.

We have now to mount these squares of pitch on to

the glass roof to make the polisher, and I may say at once that the position of the central square with regard to the center of the tool is a matter of the greatest importance. It might seem at first sight as though the most obvious way of securing uniformity of curve in the mirror would be to let the center of the tool coincide either with the center of a square or with the intersection of two grooves. This is not so. A glance at Fig. 2 will show that under these conditions a circle struck from the center of the tool would either fall almost entirely on the squares or between them. This would result in rings of unequal polish, and therefore of unequal figure, being produced in the mirror, and such rings are very hard to get rid cf if once produced. They can be completely obviated, however, if care is taken to place the center of the tool in such a position with regard to the pitch that any circle struck from this center falls about equally on the squares and between them. For this purpose the center square of pitch is placed so that the center of the tool falls just within one corner of the square, as in Fig. 3.

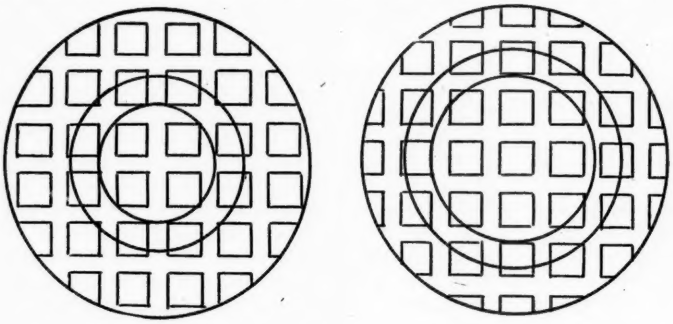


FIG. 2.

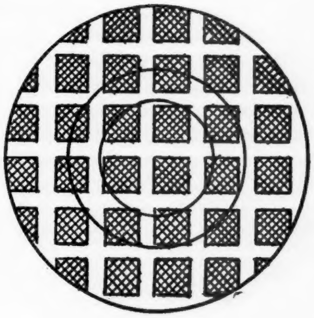


FIG. 3.

The first thing, therefore, is to mark the center of the tool accurately. Lines may then be drawn in two series at right angles to guide in placing the pitch squares. This is not absolutely necessary, as they can be placed with sufficient accuracy by eye after a little practice.

The central squares may now be placed in position as above, and I found that the easiest method was to smear the tool with a little turpentine and hold each square just above the chimney of an ordinary paraffine lamp until the under surface was melted, when it was rapidly placed in the proper position on the tool, and pressed down for a few seconds. The squares should be dried on blotting-paper as they are taken from the water, and it is very necessary that no water should be allowed to be set between the squares and the tool. The back of the tool should be examined from time to time to insure that each square has made good contact as if any of the squares are not thoroughly stuck to the glass they are sure to come loose in the polishing. The squares may be placed about $\frac{1}{4}$ or $\frac{1}{2}$ in. apart. This is to allow for a good deal of subsequent trimming. When the polisher is ready for work the intervals between the squares should be upwards of $\frac{1}{2}$ in.

A slight difficulty arises with regard to the facets at the edge of the tool. I found it best to stick the square on without attempting to break them to shape, and cut them off afterwards. When the tool is completely covered with squares, the mirror should be covered with wet blotting-paper and placed on the polisher, the edges of the mirror and polisher coinciding accurately. A chisel, held vertically and lightly struck with a small mallet, is then used to cut off the portions projecting beyond the edge, and great care must be taken that the squares at the edge of the tool are properly stuck on.

The polisher should now be warmed, either by holding it in front of a fire or by means of hot water, to soften the pitch. The mirror, still covered with wet blotting-paper, may be allowed to rest on it for a few seconds to mould the surface of the pitch to the curve of the glass, and the squares should be neatly and accurately trimmed off by means of a sharp knife or a chisel held vertically. If both chisel and pitch are kept thoroughly wet all the time (indeed, it is a good plan to do the trimming of the squares under water) there is little danger of splintering the pitch.

The polisher is alternately pressed and trimmed until all the squares have made good contact, and until they are all exactly the same size and have neat, sharp edges. Too much care and patience cannot be brought to bear on this, as a neatly and accurately made polisher is half the battle; any want of accuracy in the size of the squares is sure to cause trouble.

When the polisher is satisfactory, we may begin to think about the rouge. The rouge as sold is liable to contain a few coarse particles, and I found it essential to mix it with plenty of water and allow it to stand for a few moments to let these coarse particles settle. The rouge and water are then poured into another vessel and allowed to stand for several hours; the water being poured away. A mud or paste of rouge is left which is free from grit and which will not cause scratches.

The polisher may now be warmed up for the last time; and the mirror, painted evenly and densely with rouge and a flat camel's-hair brush, is placed on it, the blotting-paper being omitted. It is moved slowly to and fro, without pressure, and in a few minutes the

pitch will have assumed the exact curve of the mirror, and be fit for use. If any square does not make good contact, the warming and pressing should be continued for a bit longer: but this should not be necessary. It is a good plan to scratch each square diagonally, as shown in the figure, after the polisher is moulded to the curve. This lessens the friction, and makes it easier to control the stroke in polishing.

In my practice I invariably apply the rouge to the speculum, and not to the polisher; it is easier to get it even, and renders the motion much easier and more regular. The speculum is held in a triangle of hard wood, with pieces screwed on at the corners to grip the glass. A cotton-reel screwed to the center of the triangle forms a convenient handle, and the glass should be held just tight, and not subjected to any pressure, which might distort the figure. It need hardly be said that every trace of emery must be thoroughly and completely got rid of; it is very easy to scratch the surface of the glass, and impossible to get the scratches out once they are there.

In the actual polishing I hold the handle at the back of the triangle in one hand and give a stroke of about half the diameter of the mirror. The mirror is allowed to rotate quite freely, the motion being always right-handed; the stroke given is elliptical, the ellipse havhaving a breadth of about 2 in.; also the center of the ellipse is kept moving from side to side to the extent of an inch or two. This prevents rings appearing on the surface and tends to uniformity of curve. At first the friction of polishing will be considerable, but it lessens as the polish on the glass improves, and if the polisher is neatly and accurately made the motion will be easy and regular. The stroke should always be made (round the ellipse) in the same direction—right-handed or "clockwise," in my case—as if it is attempted to move the mirror in the other direction over the polisher, the friction is enormously increased and sticking is the result. Why this should be I do not know, but it has been invariably the case in my experience.

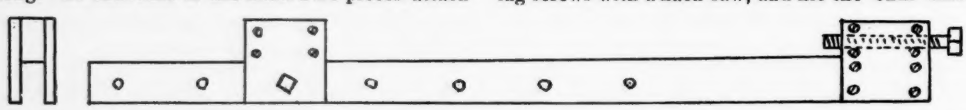
The polish will ere long begin to appear on the glass with surprising rapidity—and as soon as it does testing should be commenced. This will form the subject of my next letter, when I shall endeavor to make the theory and practice of testing as plain as possible.

In cleaning the rouge off the mirror, to test or for any other purpose, I found it better to let the mirror get quite dry, and then to clean off the rouge with soft blotting-paper. This obviates staining the hands with rouge, and is more cleanly and satisfactory.

The polisher should, of course, be carefully protected from dust when not in use, and the mirror should never be allowed to remain at rest on the polisher. The quantity of water required is difficult to describe, but it should not be too much or sticking is the result.

CABINET MAKER'S CLAMPS.

The amateur who engages in woodworking has frequent need of clamps for gluing up stock to make wide widths such as table tops, etc. Clamps for such purposes can easily be made at small expense, as here described. To make three clamps, obtain three pieces of maple or birch 6 ft. long and 2 x 3 in., which will plane down to 1¾ x 2¾ in. From each saw off two pieces each 6 in. long. Also obtain a piece of maple 6 ft. long, 5½ in. wide and ¾ in. thick, which saw into twelve pieces 6 in. long. To each side of the short 2 x 3 pieces attach



one of the ¾ in. pieces, using four 1½ in. screws. These screws must be located on either side of the center line of the block with a clearance of a little over ½ in. so that when the holes for the screws are put in, the bit will not touch any of the screws.

To one end of each of the long pieces of 2 x 3 stock, attach with screws one of these pieces we have just made. Then mark out 6 in. spaces along the long piece, the first one about 15 in. from the inner end of the screw block. Bore with a ⅝ in. bit the first hole, then move the block along to the next space and bore the next hole, using the hole in the block as a guide for starting the hole in the bar. By boring the holes in this way they will all be in line, and the bolt will fit all holes. The next thing is boring the holes in the screw block for ½ in. lag screws 9 in. long, which can be purchased at any hardware store. The bit used for the holes should be a ⅜ in. After working the screws through once or twice to get the threads well cut, saw off the pointed ends of the lag screws with a hack-saw, and file the ends smooth.

When using it is best to put a block of wood between the work and the ends of the screws.

The adjustable blocks are held with ⅝ in. bolts, 4 in. long, the heads of which are partly sunk in the side to prevent turning when screwing up the nuts. If the work is of a width which cannot be closely met by using the holes as bored, blocks of wood are used to space out with, as it is not advisable to bore more holes in the bar, thus weakening it. A set of these clamps will cost about 50 cents for material and will be found very serviceable.

THE METAL WORKING LATHE AND ITS USES.

ROBERT GIBSON GRISWOLD.

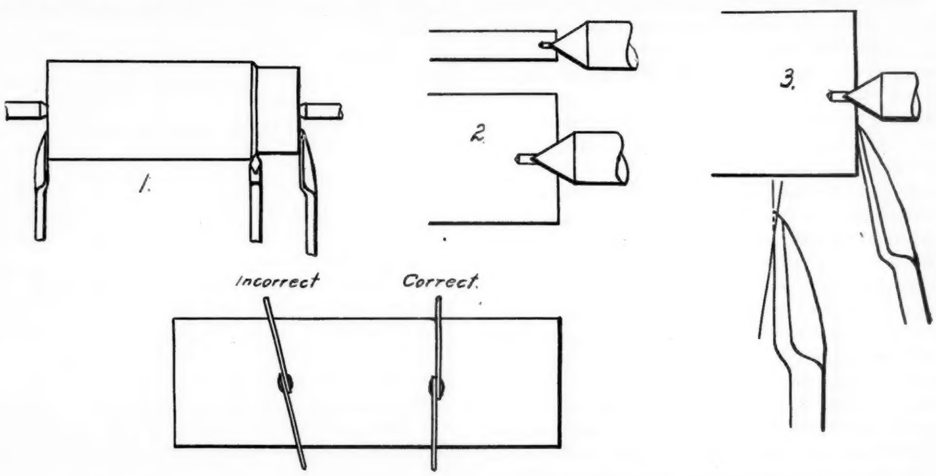
IV. Tools and Turning.

If a canvas was made throughout the various shops in this country, a great diversity of opinions would be found to exist as to just how a tool should be ground for certain work, what its shape should be and just how much feed should be given. Each lathe hand has experimented for himself and has found some particular shape and form of cutting edge that suits him best.

But the general principle upon which all lathe tools are formed is that of a wedge, and the keener the wedge the easier will be the cutting. For example, in woodworking we use tools possessing a very keen edge, obtained by grinding the tool edge on a long taper. Most every one is familiar with the smooth cutting properties of a well ground paring chisel and how very easily it will cut through the softer grained woods. But suppose we take a block of well seasoned oak and attempt to cut with the same chisel, especially by driving it with a mallet and hammer; if we are not very careful the edge will be broken off completely. Why? Simply because the edge has not sufficient strength to support the strain imposed by the heavier, harder wood.

And this principle modifies or determines just how far we can go in grinding a tool for lathe use. We know from the action of a wedge that the sharper the edge the easier it may be driven into any substance. The cutting of a chip from any piece of metal depends upon the wedge-action of the tool-edge cutting or prying off the thin layer of metal lying on one side of the wedge. But the severing of this thin chip or layer requires considerable force, and if the edge of the tool is too keen it will be broken off. This cutting action was fully described in a former chapter under "Tool-making for Amateurs."

So it is merely a question of giving a tool as keen an edge as it will hold and still do the work. A light cut will allow of a keener edge than a heavy cut, while the softer metals will pull a tool with a keen edge into them, and, although it would seem that a keen edge would be the best for such work, practice shows that the best results are obtained with tools having very little rake—almost a scraper in their action. With cast iron and steel a greater rake is permissable.



Now let us take one or more examples that will show exactly how the several shapes of tools are used in turning a piece to size. Starting with a small cylinder, as shown in Fig. 1, we will suppose that the piece is in the rough and requires considerable turned off. The piece is first centered, drilled and countersunk for the lathe centers. A word of caution here may be of value. Never make your centers unnecessarily large. Suit the center to the work—a heavy piece requiring a large countersink, while a light piece requires a very small one. Heavy cuts cause a considerable strain on the centers. and if they do not enter into the piece by a sufficient depth may easily be broken off. Fig. 2 illustrates this, showing the greater support afforded as the center enters into the work deeper and deeper. The center should always be lubricated and a mixture

of white lead and oil is probably the best as the lead affords a certain body which prevents the oil being squeezed out when the pressure of the cut is applied. A light oil will not wear well.

Another point—do not set the center up too tightly. It should have merely sufficient pressure to prevent the overhanging carrier-tail making it revolve as it passes center when the spindle is slowly revolved by hand. As the cuts continue the heat will gradually expand the piece, causing it to press more and more on the tail center, and if not relieved by slightly backing out, the tail-screw may generate sufficient heat to draw the temper of the center, when it will cut and wear very rapidly.

In taking the roughing cut, use a diamond-point tool, setting it almost at right angles to the work, as shown in Fig. 1. The clearance need not be great, probably eight or ten degrees will be enough and the top of the tool should have a rake of 8 to 15° and a side rake ranging from 15 to 20°, depending on the grade of the material being worked, machine steel allowing a 40° side rake, and sometimes even more. Side rake makes very fine cutting, especially if a lubricant is used.

The roughing cut is run across the piece until the carrier or dog interferes. The piece is then removed without backing away the tool, the carrier changed to the other end, the tool returned to the starting point and, after replacing the work the cut is finished. Since the tool position has not been altered, the cut will be continuous.

The roughing out, as its name implies, is merely used to remove the excess or superfluous stock and no pains need be taken, excepting that the cut, which should be as heavy as the lathe will carry to save time, should not spring the work. It sould, if possible, reduce the diameter of the piece to within .04 or .05 in. of size, the piece to be finished with the next two cuts.

The finishing cut may be made with the diamond point, provided it is rounded slightly with an oil stone. If the work is not very particular it may be brought to a smooth finish with a mill file and emery cloth, but grinding is the quickest and surest method of finishing a piece to size. The broad-nose finishing tool may also be used to good advantage, but a very light cut must be taken as the broad cutting surface readily induces chattering and this causes ripples over the entire surface.

In the matter of squaring the ends some prefer squaring first before the piece is turned, while others do it last. If done at first there is more metal to be removed by the side tool than if left until the last operation.

The stock should be cut almost to length, as the side tools are not able to remove much metal at a cut. If the diameter of the piece is very large, say four or five inches, the extreme point of the tool should be backed off slightly, as shown in Fig. 3 and then fed out across the end. This presents a small cutting surface and insures the end being square (provided the cross-slide ways are square with the center-line of the lathe). For small work it is quite sufficient to square the ends with the side of the tool. As work must always be turned end for end in squaring, the right side tool is the one most frequently used.

The sizes are measured with calipers. The sense of truth in calipering a piece may be developed to such a degree of sensitiveness that a difference of .001 or .002 may be easily detected. Never attempt to caliper a piece for finished size while in motion. Stop the work and carefully measure it throughout its length. The points of the calipers should just touch—no more, no less. Don't force them over and "guess" that you have it "within a hair." Get it just right. Hold the calipers truly perpendicular with the axis of the work, not canted as shown in Fig. 4.

When holding finished work in the carrier always place a strip of copper around the piece and a thick piece under the screw. This will prevent marring the work.

BOOKS RECEIVED.

PRACTICAL WOOD CARVING. Fred T. Hodgson. 284 pp. 8½ x 5 in. 185 Illustraitons. Cloth. Price $1.50. Frederick J. Drake & Co., Chicago, Ill. Supplied by AMATEUR WORK.

The amateur who desires to learn wood carving without the direction and help of an instructor, will find this work of great help, and a careful following of the instructions given therein should result in the attainment of at least a fair measure of success.

An important feature is the extended treatment of the care and uses of tools peculiar to the different classes of wood carving, as well as those common to all.

The examples given to illustrate the several chapters are decidedly better than are to be found in most books upon this subject, which, together with the completeness with which the various operations are treated, make the book one which can be cordially recommended to the beginner.

PRINTING OUT PAPERS. T. Thorne Baker. No. 69 Photo-Miniature. 25 cents. Tennant & Ward. New York.

Contains information of value and interest to every photographer who makes his own prints.

Sulphuric acid is said to have been discovered by Basil Valentine, a monk of Erfuri, in Saxony, in the fifteenth century. He obtained the acid by distilling coperas in a retort at red heat, the acid dropping from it in an oily liquid, whence the name of vitriol.

ALCHOHOL IN MANUFACTURES.

The importance of readjusting the internal revenue regulations and taxes on alcohol is clearly brought out by the United States Consul Halstead, Birmingham, England, who reports: The London, Manchester, Liverpool, Glasgow, and Birmingham chambers of commerce are taking part in the agitation to modify the restrictions placed by the inland revenue authorities upon the use of alcohol in manufacturing processes. I have reported that the chancellor of the exchequer had appointed a committee to look into the matter.

The Birmingham "Daily Post" claims that no district is so interested in the granting of the desired concessions as Birmingham, many of the principal industries in which alcohol is used being represented in or near the midland metropolis. There are a great many varnish manufacturers and lacquer makers with works in Birmingham or the immediate neighborhood. The "Post" says that "more lacquer is made in Birmingham than in all the rest of the world put together, and there can be no doubt that more of it is used than in any other place," for Birmingham is the center of the brass and other metal trades, and lacquer is used on practically every article of metal on which a high polish is desired. I quote the "Post" article in part, as follows:

It is contended that if lacquer could be made from pure, cheap spirit the metal workers would be able to turn out a better finished article at a lower price. Even in the manufacture of varnish the use of spirit that has been denatured by adding 10 per cent of wood naphtha has the effect of clouding the varnish. It is more expensive to use methylated spirit than to use pure spirit, because the cost of the methylating has to be added to the cost of the alcohol. The cost of methylated spirit is further increased by the fact that the process of methylating it is only practiced by a few firms in this country, and they are able to keep up the price. Consular returns show that during the present year, when English methylated spirit was being sold at 42 cents per gallon, alcohol of the best quality was being sold at Marseille in new, iron-bound barrels at 23 cents per gallon, less 6 per cent for cash; and the price of alcohol in Cuba was 10 cents per gallon.

The manufacturers contended that wood naphtha and turpentine are not the only effective denaturants, and that they should be allowed to mix the alcohol with denaturants that are not inimical to the process of manufacture. In the case of the lacquer manufacturers it is suggested that it is only necessary to mix the alcohol with shellac, which is impotable, and therefore would spoil the spirit for drinking purposes, but is an essential ingredient of lacquer and would improve the spirit for manufacturing purposes.

Chemists claim that the revenue authorities should be satified if they saw the alcohol mixed with one or other of the constituents of the particular drug that was in process of manufacture. Motorists would probably be content if the spirit was mixed with 10 per cent of petrol, which would render the liquid undrinkable and would improve it as a motor power. With regard to the manufacture of explosives, it is argued that if pure alcohol could be used a much cheaper and less dangerous process could be adopted. A leading firm of chemical manufacturers at Bristol states that practically the whole of the trade in drugs containing alcohol has got into the hands of the Germans because of the duty on alcohol.

On paper it seems that the Germans are not allowed to use absolutely pure alcohol duty free, but Mr. Barlow states that he has bought cheap alcohol in Germany which on analysis showed no signs of a denaturant except a small percentage of shellac, and there is documentary evidence to show that the restrictions in Germany are very much lighter than in this country. Instead of 10 per cent of wood naphtha Germans may mix with the alcohol 2 per cent of wood naphtha and 2 per cent of petroleum benzine or 0.5 per cent of turpentine. These quantities are so small that they do not appreciably affect the nature of the spirit, and there are many exceptions to these regulations. Under certain conditions the infinitesimal amount of .025 per cent animal oil may be used. The principle that the denaturant should be adapted to the commercial purpose for which the alcohol is to be used is largely carried out in Germany and also in France. For instance, in the manufacture of collodion, the alcohol may be mixed with 10 per cent of ether, which is a necessary ingredient of collodion.

In answer to the objection on the part of the inland revenue authorities that a relaxation of the existing restrictions would open the way to illicit dealing in spirits, Mr. Barlow contends that this could be obviated by granting the privilege only to those firms which are able to satisfy the revenue officers that the alcohol is duly mixed with the denaturant, and that it is actually used in the process of manufacture. He suggests that alcohol should be run direct into sealed tanks containing the shellac, petrol or ether, as the case may be.

The transmission of electrical energy by wires is nowhere more perfected than through the mining districts of the West. The increasing tendency to raise the line voltage in such transmissions has enormously increased the capacity of many lines, for we find today lines in successful operation with voltages running from 40,000 to 60,000, as compared with 4000 to 6000 volts of a few years ago.

ELECTRIC SHOCKS.

One of the new and not uncommon dangers of modern life is that of getting in the way of a powerful current of electricity and receiving the entire discharge through the body. The effects of such a discharge vary, of course, with the strength of the current. There may be simply a sharp muscular contraction accompanied by a familiar, disagreeable sensation of an electric shock; these contractions may be repeated several times after the current has ceased, constituting true convulsions, or there may be a persistent continued muscular contraction. There may be suspended respiration while the heart continues to beat; both heart and respiration may cease, in which case death will speedily follow unless instant medical relief is at hand or in other cases death may be instantaneous.

The first care is, of course, to free the person from contact with the live wire, and here great caution is necessary, or the giver of assistance may share the fate of the one he is trying to help. He must himself be insulated before touching the victim's body, if the latter is still within the path of the current, and this is especially important if the accident has happened out of doors on a wet day. Care should be taken also not to let any part of the body other than the hands, or rather one hand, touch the electrified person.

It may not be possible to pull the sufferer away from the source of electricity, and if not it will be necessary to make a short circuit by dropping a stiff wire or a metal tool of any kind over the live wire or cutting the wire.

Insulation is best obtained by rubber boots and gloves, but in the absence of these, standing on a folded coat or a woman's silk skirt and putting on thick wollen gloves or wrapping the hands in several folds of silk, woolen or cotton cloth, which of course must be dry. A dry board or several newspapers, or better still, both, may serve as an emergency insulating stool.

When the victim has been freed from the current he should be placed so that he can have plenty of fresh air. In severe cases artificial respiration will almost always be needed, just as it is in cases of drowning, and an early resort to it may save a life that would otherwise inevitably be lost.

HOW PINS ARE MADE.

The United States practically supplies the world with pins. In this country we use annually of common pins no less than ten billion, or ten thousand million. This is an average of not far from 136 pins for every inhabitant of the country. The total number of pins manufactured in the United States for 1900 was 68,889,260 gross. There were 43 pin factories which employed 2500 people. Pins are turned out automatically, and one machine is capable of producing several thousand gross of pins per hour. Coils of wire hung upon reels are passed into machines that cut the proper length of wire for the pins. They drop into a receptacle and mechanically arrange themselves in the line of a slot formed by two bars. When they reach the lower end of the bars they are seized and pressed between two discs, that forms the heads, and pass along into the grip of another steel instrument, which points them by pressure. Then they are dropped into a solution of sour beer, whirling as they go, to be cleaned and then into a hot solution of tin that is also kept revolving. Here they get their bright coat of tin, then are pushed along until sufficiently hardened, when dropped into a revolving barrel of bran and sawdust, which cools and polishes them at the same time. Through the oscillations of this barrel the pins work gradually down to the barrel's bottom, which is a metallic plate cut into slits just big enough for the body of the pins but not large enough for the head to pass through. Thus they are straightened out into rows again, and, like well drilled soldiers, pass along toward the edge of the bottom and slide down an inclined plane, still hanging by their heads, until they reach strips of paper into which they are inserted by a peculiar jerk of the machine. The consumption of iron in the manufacture of pins foots up in the neighborhood of 15,000 tons yearly.

ALUMINUM PLATING PROCESS.

Aluminum, on account of its great lightness and its toughness when alloyed with other metals, has, since its production, been so enormously cheapened, come into general use for a multiplicity of purposes. But one great drawback to its use is the rapidity with which its surface becomes dull and leaden in hue owing to rapid oxidation. This characteristic has hitherto prevented aluminum from being easily electroplated with gold or silver, as copper may be; but, according to an announcement in the Electro-Chemical Industry, this difficulty has been removed by the discovery of a method by which aluminum can be given a coating of any desired metal. The film of oxide which covers the surface of the aluminum is removed by adding to the plating bath a small quantity of soluble fluoride and the metal then receives a superficial coating of the zinc or copper, upon which silver or gold can be subsequently deposited. The new process will doubtless be highly valued by the makers of opera glasses, photographic lenses, telescopes and other instruments.

The Krupp Works, Germany, cover in area 1500 acres and daily output is 1877 tons. Alfred Krupp has built for his operatives 5500 dwellings and maintains a pension fund of $4,125,000 for their benefit.

SCIENCE AND INDUSTRY.

Two men employed in an Edinburgh rope factory have invented an apparatus for carrying off dust and bad air created by the machinery used in the flax industry. The principal sources of dust in a flax-preparing machine are the feed and delivery rollers. Over each of these parts is suspended a duct or flattened tube. An air-propelling fan, driven by belt and pulley, rotates in this horizontal tube. The tube may be made of such size and the fan of such power as to serve for ventilating a number of machines. To the lower part of the tube, ducts of flattened trumpet-mouth or rectangular shape are hinged at such an angle as to have their elongated narrow mouths over the rollers of one machine, or, it may be, two machines. Sliding doors, rotating grids or equivalent devices, are fitted in these ducts to regulate the draft of air. Cords or chains are secured to the lower ends of the ducts and carried on pulleys, so that the ducts can be drawn up to give room when the machine is being cleaned or repaired. The dust and bad air drawn away from the machine by the suction caused by the centrifugal fan are carried off by a duct attached to the fan duct, and are discharged in the atmosphere or in any receptacle where water may be employed. The estimated cost of making these machines is $50 each.

In a brief account in the "American Journal of Science" for June, of late mineral researches in Llano County, Tex., which have been made by him, Mr. William E. Hidden mentions a peculiar formation which he encountered. He found unusually long radial lines projecting in many directions from the bodies of ore richest in thorium, uranium and zirconium. He called these occurrences stars, and sought for them as positive pointers to ore. Finally, on removing a seventy-pound mass of zirconium-yttrium-uranium and thorium ore, which was a nucleus to one of the best marked of these stars, from its quartz matrix, his hands and face began to burn as if from the effect of strong sunlight, and after three days of this kind of mining a redness of skin and a burning sensation resulted which was followed by an actual soreness of the parts of his hands and face exposed to the direct emanations from the minerals. The author suggests that this burning be due to the work of a radioactive element of a peculiar if not unique kind.

U. S. Consul, T. W. Martin, of Nottingham, Eng., in a report says it is announced that a Lancaster mechanic, Dennis Flanagan, has invented what has long been needed but unsuccessfully attempted—a machine which will sew direct from two spools of thread, thus obviating the winding of spools and threading of the shuttles. Experts are quoted to the effect that if the invention is put on the market it will revolutionize the sewing machine trade of the world.

Flanagan has been experimenting since 1889, it is said, and that owing to the machine sewing direct from two spools of thread, there is an absence of complicated mechanism in consequence of which there is little chance of its getting out of order. A remarkable feature is the small number of parts required in in its construction and, as the cost of production will, comparatively speaking, be small, it is expected that the contrivance will be put on the market at a price far below that charged for most sewing machines.

The Chinese Government, according to German papers, has granted its first patent. It is for an electric lamp, the inventor of which is an inhabitant of Nankin, the old capital of China, who calls his lamp the "bright moonlight," and asserts that it is far superior to foreign glow lights that hitherto have been sold at Shanghai and other Chinese cities. The fact that China has entered upon the granting of letters patent is undoubtedly of more importance than the invention.

High speed trials of steam locomotives on the military railway between Marienfelde and Zossen, in Germany, have shown that the superheated steam loco-gives the best satisfaction. The trials have shown that this type of locomotive is more powerful than the usual express type, that it can cover greater distances without changing and is more economical of coal and water, but it is stated that it requires 32 per cent more lubricating oil.

Electric waves which were measured by Hertz and named after him were found to be 150 feet from the top of one wave to the top of the next. The waves used by Marconi in wireless telegraphy are said to be 600 feet or more in length and travel at the same speed as light, 184,000 miles a second. The light wave measures only a few millionths of an inch in length.

Development of the internal combustion engine for marine purposes means that, in the adoption of the now familiar motor boat, the same ranges of power and action as are obtained by the best reciprocating engines and boilers can be secured at one-sixth of the weight with the new motor. The British Admiralty are so convinced of the advantages of the combustion engine that they have carried out at sea a series of experiments, and there is some talk of utilizing this type of engine in the new torpedo boats which are about to be built.

Nitro-glycerine, or glyceryl nitrate, is a light yellow, oily liquid, which, under the action of a fulminating cap, explodes with great violence. It was found so dangerous that its use by itself was given up and the mixture of nitro-glycerine and infusorial earth (dynamite), has been used for some time past.

Markets belong to those who get them. The battle of trade today is to the strong, the swift, the alert and the intelligent. Trade plums do not drop into the mouths of those lying under the trees, but to those who shake the trees.

An excellent cement for splicing leather belting, recommended by a practical mechanic, is to thoroughly cook six ounces of the best white glue and then add two ounces of powdered white lead immediately after lifting from the fire, incorporating the two ingredients by thorough stirring, then pour into a shallow greased pan to cool and season for future use. Make the splice of the belt the same length as its width. Cut off a sufficiently large piece of the cement and dip it for a moment in scalding hot water and apply to the skived surfaces until they are completely covered, and neatly joint the two pieces together and hammer down smooth. The belt may be put into service within an hour.

It is possible to prevent the smoke from magnesium ribbon or powder spreading through the room by placing over it a large flat pad of damp wool lint. The lint should be tacked to a piece of flat board and supported on legs, just about the point where the ignition takes place—at such a height, of course, as not to interfere with the flash. The damp lint absorbs most of the products of combustion, and so prevents the usual cloud arising.

The conditions which insure a steady and abundant flow of water in mountain streams is not so much heavy rainfall as a heavy snowfall in the mouutains, and for the best results it is the snow which falls in the early part of winter, and which becomes hard and compact during the winter season by successive rain and snowfalls until it is almost a mass of ice rather than snow. This melts slowly and maintains a summer supply.

Phosphorous, because of its tendency to ignite under the influence of frictional heat, is used in the making of matches. For this purpose it is usually combined with manganese dioxide, chalk and glue. Safety matches are made of a mixture of potassium chlorate, potassium bichromate and antimony trisulphide. This combination will not ignite readily by ordinary friction, but takes fire when drawn across a paper coated with antimony pentasulphide and red phosphorus.

The crank pin and cross head of an engine do not travel at the same rate throughout a revolution of the crank shaft. The crank pin travels at a constant speed, but the crosshead is constantly traveling at an accelerating or diminishing speed throughout the forward and backward stroke, coming to practically an absolute but only momentary standstill at either end, the duration of rest being so small that it is claimed by some that the crosshead does not actually stop at all.

CORRESPONDENCE.

No. 98. LOWELL, MASS., July 10, 1905.

I would very much like to correspond with any readers of AMATEUR WORK living in this sectton who are interested in wireless telegraphy. An interchange of ideas and the results of experimental work would undoubtedly prove profitable. Kindly address "Wireless" 54 Middle Street, Lowell, Mass.

Those at a greater distance than that mentioned above are invited to write their experiences for publication in this column that all readers may profit therefrom.

No. 99. FRANKLIN FALLS, N. H., July 12, '05.

Kindly advise if a glass plate condenser is as good as a Leyden jar for "Wireless" work. What will a thin glass tube 4 in. diameter and 8 in. long cost? Also of hard rubber of same dimensions? C. E. H.

There is no appreciable difference if equally well made and of the same capacity. The tube, either of glass or rubber, would probably have to be made to order, and cost about $4 for glass and $2.50 for rubber. The glass tube might be made from a glass bottle, to be found by searching among glassware dealers.

No. 100. SOMERVILLE, MASS., July 8, '05.

How can I gain admittance to the stations of the United States Government wireless telegraph stations? F. E. W.

Write a letter to the Chief Electrician of the station you desire to visit, stating your request, which may or may not secure the desired permission, this depending greatly on the conditions of business duties. On certain days visitors are generally allowed at Navy yards, and you might try on one of these days.

No. 101. MINNEAPOLIS, KAN., July 7, '05.

Would you advise amateurs to buy magnet wire and attempt to wind a small spark coil for a ¼ in. spark, and is it difficult to wind small coils? D. N. R.

Success in coil winding depends largely on the skill of the operator and care taken in the work. The small size you mention should be an easy matter, but it would hardly seem worth while to fit up for a coil of that size. With larger coils the preliminary work of making a winder, etc., is, of course, a necessity. The work has an educational and instructive value, which makes it necessary for each one to decide for himself whether making or buying a coil is advisable.

No. 102. PROVIDENCE, R. I., July 11, '05.

Please tell me the best kind of paper to use in a condenser for a 1-inch spark coil. I do not know the kind to use between the layers of tinfoil. D. C. W.

A strong waxed paper is placed between the different layers of tinfoil in a condenser. You may be able to find at a confectioner's or baker's paper which would be suitable, but each sheet must be carefully examined to see that it contains no pin holes. If unable to buy suitable waxed paper it may be made by dipping thin bond writing paper in melted paraffine, allowing same to become hard, and then pressing smooth with a flatiron slightly warmed. The latter paper will be best, being much stronger than any waxed paper you can ordinarily purchase.